Ministry of Agriculture of the Russian Federation
Federal State Budgetary Educational Institution
of Higher Education
"St. Petersburg State University of Veterinary Medicine"

APPROVED BY
Vice-Rector for Educational
Work and Youth Policy
_____ A.A. Sukhinin
10 April, 2026

Department of Biology, Ecology and Histology

EDUCATIONAL WORK PROGRAM

for the discipline

"CYTOLOGY, HISTOLOGY AND EMBRYOLOGY"

The level of higher education
SPECIALIST COURSE
Specialty 36.05.01 Veterinary Medicine
Profile: «General clinical veterinary medicine»
Full-time education

Education starts in 2026

Reviewed and adopted
at the meeting of the department
on March 03, 2026
Protocol No. 7

Head of the Department of Biology, Ecology and Histology,
Doctor of Veterinary Sciences, Associate Professor
_____ M.E. Mkrtchyan

Saint Petersburg
2026

1. GOALS AND OBJECTIVES OF THE DISCIPLINE

The main purpose of the discipline in the training of veterinarians is to give students fundamental morphological knowledge at the cellular and subcellular levels about a functioning, developing and adapting organism and the patterns of its development in ontogenesis.

To achieve this goal, it is necessary to solve the following tasks:

a) The general educational task is to familiarize students in-depth with the structural organization of animals at the tissue and cellular levels and provides fundamental biological education in accordance with the requirements for higher educational institutions of a biological profile.

b) The applied task highlights issues related to functional histology, cytology and embryology and creates a conceptual framework for the implementation of interdisciplinary structural and logical connections in order to develop medical thinking skills.

c) A special task is to familiarize students with modern trends and methodological approaches used in cytology, histology and general embryology to solve problems of animal husbandry and veterinary medicine, as well as existing achievements in this field.

2. THE LIST OF PLANNED RESULTS OF MASTERING THE DISCIPLINE (MODULE), CORRELATED WITH THE PLANNED RESULTS OF MASTERING THE EDUCATIONAL PROGRAM

As a result of mastering the discipline, the student prepares for the following types of activities, in accordance with the educational standard of the Federal State Educational Standard on 36.05.01 "Veterinary Medicine".

The field of professional activity:

13 Agriculture

Types of tasks of professional activity:

• Medical

The universal competencies formed as a result of mastering the discipline

The study of the discipline should form the following competencies:

a) Universal competencies:

GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results.

GPC-4 ID-1

To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity.

GPC-4 ID-2

To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained.

GPC-4 ID-3

To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.

3. THE PLACE OF DISCIPLINE IN THE STRUCTURE OF THE MPEP

Discipline B1.O.08 "Cytology, histology and embryology" is a mandatory discipline of the Federal state educational standard of higher education in the specialty 36.05.01 "Veterinary Medicine" (specialty level).

It is mastered: full-time - in the 2nd and 3rd semesters.

When teaching the discipline "Cytology, histology and embryology", the knowledge and skills acquired by students during the development of the disciplines of zoology, anatomy, biology with the basics of ecology, biochemistry, physiology are used. The discipline of Cytology, Histology and Embryology is the basic one on which most subsequent disciplines are based, such as:

1. Animal physiology.
2. Pathological physiology of animals
3. Operative surgery with topographic anatomy.
4. Clinical diagnosis.
5. Internal non-communicable diseases.
6. Pathological anatomy of animals.
7. Veterinary and sanitary examination.
8. Obstetrics and gynecology.
9. Diseases of laboratory, small and exotic animals.
10. Diseases of birds.

4. THE SCOPE OF THE DISCIPLINE "CYTOLOGY, HISTOLOGY AND EMBRYOLOGY"

4.1. The scope of the discipline "Cytology, histology and embryology" for full-time education

Type of educational work	Total hours	Semesters	
		2	3
Class work (total)	**136**	**68**	**68**
Including	-	-	-
Lectures, including interactive forms	68	34	34
Practical lessons (PL), including interactive forms	68	34	34
Practical training (PT)	16	8	8
Independent work (total)	**152**	**76**	**76**
Type of intermediate certification (test, exam)	**Test – 2 Exam–3**	**Test**	**exam**
Essay	+	-	+
Total labor intensity hours / credit points	**288/8**	**144/4**	**144/4**

5. THE CONTENT OF THE DISCIPLINE "CYTOLOGY, HISTOLOGY AND EMBRYOLOGY"

5.1. The content of the discipline "Cytology, histology and embryology" for full-time education

№	Name	Forming competencies	Semester	Types of academic work, including students' independent work and labor intensity (in hours)			
				L	PL	PT	IW
1.	Introduction to histology. The goals, objectives and place of histology in the training of a veterinarian. The history of science. Classical and modern methods of histological research.	**GPC-4**. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.	2	2	2	4	6
2.	Introduction to cytology. The structure of the cell. The hereditary apparatus of the cell. Mitosis, course and biological significance. Amitosis, endomitosis.	**GPC-4.** Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity.	2	8	8		10

		GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.					
3.	Morphofunctional features of germ cells. Gametogenesis. The course and essence of meiosis. Fertilization.	**GPC-4.** Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.	2	2	2		4
4.	Introduction to embryology. The main stages of the embryonic development of the lanceolate.	**GPC-4.** Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained.	2	2	2		4

		GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.					
5.	The main stages of embryonic development of amphibians.	**GPC-4**. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.	2	2	2		4
6.	Features of the early stages of embryonic development of birds. Formation and significance of extra-germ membranes.	**GPC-4.** Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.	2	2	2		8

7.	Features of the early stages of mammalian embryonic development. Formation and significance of extra-germ membranes. Placenta: role, types.	**GPC-4**. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.	2	2	2		8
8.	The concept of tissues. Morphofunctional and genetic classification of tissues. Characteristics of the epithelial group.	**GPC-4.** Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.	2	2	2		8
9.	Characteristics of the group of musculoskeletal trophic tissues.	**GPC-4**. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results.	2	8	2	-	12

		GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.					
10.	Development, structure, classification of muscle tissues. Diagnosis of drugs.	**GPC-4.** Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.	2	2	2	4	6
11.	Development and classification of nervous tissues of the central nervous system and PNS.	**GPC-4**. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity.	2	2	-		4

		GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.					
	TOTAL FOR 2 SEMESTERS		**2**	**34**	**26**	**8**	**76**
12.	Features of the structure and function of the central nervous system organs: spinal cord, cerebral cortex, cerebellum. Types of reflex arcs.	**GPC-4.** Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.	3	2	2		6
13.	The cardiovascular system.	**GPC-4.** Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained.	3	2	2		6

		GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.					
14.	Organs of hematopoiesis and immune protection.	**GPC-4**. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.	3	2	2		6
15.	Histophysiology of the endocrine glands.	**GPC-4.** Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.	3	4	2		6

16.	Histophysiology of the gastrointestinal tract.	**GPC-4**. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.	3	4	2	2	8
17.	Histophysiology of the liver and pancreas, specific features and vascularization of the gland.	**GPC**-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.	3	2	2	2	6
18.	Histophysiology of the respiratory organs.	**GPC-4.** Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results.					6

		GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.					
19.	Phylogeny and ontogenesis of the excretory organs. The structure of the kidney. Histophysiology of the nephron.	**GPC-4.** Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.					6
20.	The structure and development of the reproductive system of males and females.	**GPC-4**. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1					8

		To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.					
21.	Leather and its derivatives.	**GPC-4**. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.					6
22	Morphofunctional interactions of cells in the immune response. Diagnostics.	**GPC-4**. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1				4	6

		To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.					
23	Features of the structure of tissues and organs of birds.	**GPC-4**. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results. GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity. GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained. GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.					6
TOTAL FOR 3ND SEMESTERS				**34**	**26**	**8**	**76**

6. THE LIST OF EDUCATIONAL AND METHODOLOGICAL SUPPORT FOR INDEPENDENT WORK

6.1. Guidelines for independent work

1. Ivanov V. S., Antonova V. A. Obshchaya gistologiya i embriologiya [General histology and embryology] / V.S.Ivanov, V.A. Antonova - St. Petersburg: SPbGAVM, 2013. – 35 p.

6.2. Literature for independent work

1. Veterinary Histology / Ryan Jennings, Christopher Premanandan. - B.m. : [Ohio State University Libraries], [2017]. - 245 p. – URL: https://search.spbguvm.informsystema.ru/viewer.jsp?aWQ9MjEwMTUmcHM9MjU0 (date of access: March 3, 2026). - Access mode: for authorization. EB SPbGUVM users. - Text: electronic.

7. THE LIST OF BASIC AND ADDITIONAL LITERATURE NECESSARY FOR THE DEVELOPMENT OF THE DISCIPLINE

a) basic literature:

1. Mkrtchyan, M. E. Cytology, Embryology, General Histology: study guide / M. E. Mkrtchyan, D. I. Safronov, E. N. Taimusova. – Saint-Petersburg: Federal State Budgetary Educational Institution of Higher Education St. Petersburg State University of Veterinary Medicine, 2023. – 117 p. - Text: direct.

b) additional literature:

1. Anatomy and histology of the domestic chicken / edited by Wael Khamas, Josep Rutllant. - Hoboken; New Jersey: Wiley-Blackwell, [2024]. - 238 p. – URL: https://search.spbguvm.informsystema.ru/viewer.jsp?aWQ9MjEwNDcmcHM9MjYy (date of access: March 3, 2026). - Access mode: for authorization. EB SPbGUVM users. - Text: electronic.

8. THE LIST OF RESOURCES OF THE INFORMATION AND TELECOMMUNICATION NETWORK "INTERNET" NECESSARY FOR THE DEVELOPMENT OF THE DISCIPLINE

To prepare for practical classes and perform independent work, students can use the following online resources:

1. LUMEN: Histology Index is part of the Loyola University Medical Education Network (Chicago, USA). An extensive database of histological images on cytology, tissue types and organ systems, consisting of 23 sections.

2. Cellsalive. URL: https://lk.spbgavm.ru/course/view.php?id=193 www.cytohistology.ru

Electronic library systems:

1. EBS "SPBGUVM"
3. EBS "Student Consultant"
4. Legal reference system "ConsultantPlus"
5. University information system "RUSSIA"
6. Full-text database POLPRED.COM
7. Scientific electronic Library ELIBRARY.RU
8. Russian Scientific Network
9. Electronic library system IQlib

11. Electronic books of the publishing house "Prospekt Nauki" http://prospektnauki.ru/ebook

12. Collection "Agriculture. Veterinary medicine" publishing house "Quadro" http://www.iprbookshop.ru/586.html

9. METHODOLOGICAL GUIDELINES FOR STUDENTS ON THE DEVELOPMENT OF THE DISCIPLINE

Methodological recommendations for students are a set of recommendations and explanations that allow the student to optimally organize the process of studying this discipline.

The content of methodological recommendations, as a rule, may include:

• Tips on planning and organizing the time needed to study the discipline. Description of the sequence of actions of the student, or the "scenario of studying the discipline".

Morning time is the most fruitful for academic work (from 8-14 hours), followed by afternoon time (from 16-19 hours) and evening time (from 20-24 hours). The most difficult material is recommended to be studied at the beginning of each time interval after rest. After 1.5 hours of work, a break is required (10-15 minutes), after 4 hours of work, the break should be 1 hour. Part of the scientific organization of labor is the mastery of the technique of mental labor. Normally, a student should devote about 10 hours a day to studying (6 hours at university, 4 hours at home).

• Recommendations for working on lecture material

When preparing for a lecture, the student is recommended:

1) view the recordings of the previous lecture and restore the previously studied material in memory;

2) it is useful to review the upcoming material of a future lecture;

3) if an independent study of individual fragments of the topic of the last lecture is set, then it must be completed without delay;

4) psychologically tune in to the lecture.

This work includes two main stages: lecture notes and subsequent work on lecture material.

Taking notes means making a synopsis, i.e. a brief written statement of the content of something (an oral presentation - a speech, lecture, report, etc. or a written source – a document, article, book, etc.).

The methodology of work when taking notes of oral presentations differs significantly from the methodology of work when taking notes of written sources.

By taking notes of written sources, the student has the opportunity to repeatedly read the desired passage of the text, reflect on it, highlight the main thoughts of the author, briefly formulate them, and then write them down. If necessary, he can also note his attitude to this point of view. Listening to the lecture, the student should postpone most of the complex of the above–mentioned works for another time, trying to use every minute to record the lecture, and not to comprehend it - there is no time left for this. Therefore, when taking notes of a lecture, it is recommended to separate fields on each page for subsequent entries in addition to the summary.

After recording a lecture or making a summary of it, you should not leave work on the lecture material before preparing for the test. It is necessary to do as early as possible the work that accompanies taking notes of written sources and which could not be done during the recording of the lecture - read your notes, deciphering individual abbreviations, analyze the text, establish logical connections between its elements, in some cases show them graphically, highlight the main thoughts, mark issues requiring additional processing, in particular, the teacher's consultations.

When working on the text of the lecture, the student should pay special attention to the problematic issues raised by the teacher during the lecture, as well as to his assignments and recommendations.

For each lecture, practical lesson and laboratory work, the number, topic, list of issues under consideration, volume in hours and links to recommended literature are provided. For classes conducted in interactive forms, their organizational form should be indicated: computer simulation, business or role-playing game, analysis of a specific situation, etc.

• Recommendations for preparing for practical classes

Practical (seminar) classes are an important part of the professional training of students. The main purpose of conducting practical (seminar) classes is to form students' analytical, creative thinking through the acquisition of practical skills. Practical classes are also conducted in order to deepen and consolidate the knowledge gained in lectures and in the process of independent work on normative documents, educational and scientific literature. When preparing for a practical lesson for students, it is necessary to study or repeat theoretical material on a given topic.

When preparing for a practical lesson, the student is recommended to follow the following algorithm;

1) get acquainted with the plan of the upcoming lesson;

2) study the literature sources that have been recommended and familiarize yourself with the introductory notes to the relevant sections.

Methodological guidelines for practical (seminar) classes in the discipline, along with the work program and schedule of the educational process, refer to methodological documents that determine the level of organization and quality of the educational process.

The content of practical (seminar) classes is recorded in the working curricula of the disciplines in the sections "List of topics of practical (seminar) classes".

The most important component of any form of practical training is assignments. The basis of the assignment is an example that is understood from the standpoint of the theory developed in the lecture. As a rule, the main attention is paid to the formation of specific skills, which determines the content of students' activities - problem solving, laboratory work, clarification of categories and concepts of science, which are a prerequisite for correct thinking and speech.

Practical (seminar) classes perform the following tasks:

- stimulate regular study of recommended literature, as well as attentive attitude to the lecture course;
- consolidate the knowledge gained in the process of lecture training and independent work on literature;
- expand the scope of professionally significant knowledge, skills, and abilities;
- allow you to verify the correctness of previously acquired knowledge;
- instill skills of independent thinking, oral presentation;
- contribute to the free operation of terminology;
- provide the teacher with the opportunity to systematically monitor the level of independent work of students.

Methodological guidelines for practical (seminar) classes in the discipline should be focused on modern business conditions, current regulatory documents, advanced technologies, the latest achievements of science, technology and practice, modern ideas about certain phenomena, the studied reality.

• Recommendations for working with literature.

Working with literature is an important stage of the student's independent work on mastering the subject, contributing not only to the consolidation of knowledge, but also to the expansion of horizons, mental abilities, memory, the ability to think, express and confirm their hypotheses and ideas. In addition, the skills of research work necessary for further professional activity are being developed.

When starting to study the literature on the topic, it is necessary to make notes, extracts, notes. It is mandatory to take notes of the works of theorists, which allow us to comprehend the theoretical basis of the study. For the rest, you can limit yourself to extracts from the studied sources. All extracts and quotations must have the exact "return address" (author, title of the work, year of publication, page, etc.). It is advisable to write an abbreviated title of the question to which the extract or quotation refers. In addition, it is necessary to learn how to immediately compile a file of special literature and publications of sources, both proposed by the teacher and identified independently, as well as refer to bibliographic reference books, chronicles of journal articles, book chronicles, abstract journals. At the same time, publications of sources (articles, book titles, etc.) should be written on separate cards, which must be filled in according to the rules of

bibliographic description (surname, initials of the author, title of the work. Place of publication, publisher, year of publication, number of pages, and for journal articles – the name of the journal, year of publication, page numbers). On each card, it is advisable to record the thought of the author of the book or a fact from this book on only one specific issue. If the work, even in the same paragraph or phrase, contains more judgments or facts on another issue, then they should be written out on a separate card. The presentation should be concise, accurate, without subjective assessments. On the back of the card, you can make your own notes about this book or article, its content, structure, on which sources it is written, etc.

• Explanations about working with control and test materials for the course, recommendations for completing homework.

Testing is a test that allows you to determine whether the actual behavior of the program corresponds to the expected one by performing a specially selected set of tests. A test is the fulfillment of certain conditions and actions necessary to verify the operation of the function under test or part of it. Each question in the discipline must be answered correctly by choosing one option.

10. EDUCATIONAL WORK

As part of the implementation of the discipline, educational work is carried out to form a modern scientific worldview and a system of basic values, the formation and development of spiritual and moral, civil and patriotic values, a system of aesthetic and ethical knowledge and values, attitudes of tolerant consciousness in society, the formation of students' need for work as the first vital necessity, the highest value and the main way to achieve to achieve success in life, to realize the social significance of your future profession.

11. THE LIST OF INFORMATION TECHNOLOGIES USED IN THE IMPLEMENTATION OF THE EDUCATIONAL PROCESS

The educational process of the discipline provides for the use of information technology:

- conducting practical classes using multimedia;

interactive technologies (conducting dialogues, collective discussion of various approaches to solving a particular educational and professional task);

- interaction with students via e - mail;
- joint work in the Electronic information and educational environment of St. Petersburg State University: https://spbguvm.ru/academy/eios/

11.2. Software

The list of licensed and freely distributed software, including domestic production

№	The name of the technical and computer training tools recommended by sections and topics of the program	License
1	MS PowerPoint	67580828
2	LibreOffice	free software
3	OS Alt Obrazovanie 8	AAO.0022.00
4	ABIS "MAPK-SQL"	02102014155
5	MS Windows 10	67580828
6	Sistema KonsultantPlyus	503/КЛ
7	Android OC	free software

12. THE MATERIAL AND TECHNICAL BASE NECESSARY FOR THE IMPLEMENTATION OF THE EDUCATIONAL PROCESS IN THE DISCIPLINE

The name of the discipline (module), practice in accordance with the curriculum	The name of special rooms and rooms for independent work	Equipment of special rooms and rooms for independent work
Cytology, histology and embryology	246 (196084, St. Petersburg, Chernihiv str., 5) Classroom for conducting seminar-type classes, group and individual consultations, ongoing monitoring and intermediate certification	Specialized furniture: blackboard, tables, chairs. Technical training facilities: a TV, a computer with a connected microscope and a camera. Visual aids and educational materials: histological preparations; microscopes, posters on sections of histology
	224 (196084, St. Petersburg, Chernihiv str., 5) Classroom for conducting seminar-type classes, group and individual consultations, ongoing monitoring and intermediate certification	*Specialized furniture:* blackboard, tables, chairs. *Technical training tools*: Interactive whiteboard. *Visual aids and educational materials:* histological preparations; microscopes, table lamps, posters on sections of histology.
	206 Large reading room (196084, St. Petersburg, Chernihiv str., house 5) Room for independent work	*Specialized furniture:* tables, chairs *Technical means of education:* computers connected to the Internet and access to an electronic information and educational environment
	214 Small reading room (196084, St. Petersburg, Chernihiv str., house 5) Room for independent work	*Specialized furniture:* tables, chairs *Technical means of education:* computers connected to the Internet and access to an electronic information and educational environment
	324 Information Technology Department (196084, St. Petersburg, Chernihiv str., house 5) Room for storage and preventive maintenance of educational equipment	*Specialized furniture:* tables, chairs, special equipment, materials and spare parts for preventive maintenance of technical training facilities
	Box No. 3 Carpentry workshop (196084, St. Petersburg, Chernihiv str., house 5) A room for storage and preventive maintenance of educational equipment	*Specialized furniture:* tables, chairs, special equipment, materials for preventive maintenance of specialized furniture

Developer:
Doctor of Veterinary Sciences,
Associate Professor _____ M.E. Mkrtchyan

Annex

Ministry of Agriculture of the Russian Federation
Federal State Budgetary Educational Institution
Of higher education
"St. Petersburg State University of Veterinary Medicine"

Department of Biology, Ecology, Histology

FUND OF ASSESMENT TOOLS
for the discipline

" CYTOLOGY, HISTOLOGY AND EMBRYOLOGY "
Level of higher education
SPECIALIST COURSE
Specialty 36.05.01 Veterinary Medicine
Profile: «General clinical veterinary medicine»
Full-time education

Education starts in 2026

Saint Petersburg
2026

1. PASSPORT OF THE APPRAISAL FUND

Table 1

№	Emerging competencies	Supervised sections (topics) of the discipline	Evaluation tool
1.	GPC-4 ID-1 ID-2 ID-3	Section 1. Cytology	Colloquium, tests
2.		Section 2. Embryology	Tests
3.		Section 3. Epithelial tissues	Interview (survey)
4.		Section 4. Musculoskeletal and trophic tissues	Interview (survey)
5.		Section 5. Muscle tissue	Colloquium, tests
6.		Section 6. Nervous tissue	Interview (survey)
7.		Section 7. Organs of the nervous system	Colloquium, tests
8.		Section 8. Sensory organs	Interview (survey)
9.		Section 9. Organs of the cardiovascular system.	Colloquium
10.		Section 10. Organs of hematopoiesis and immunogenesis	Colloquium, tests
11.		Section 11. Glands of internal secretion.	Interview (survey)
12.		Section 12. Organs of the digestive system.	Interview (survey).
13.		Section 13. Organs of the respiratory system.	Interview (survey)
14.		Section 14. Organs of the excretory system.	Colloquium,
15.		Section 15. The reproductive system of males and females.	Interview (survey)
16.		Section 16. Leather and its derivatives.	Colloquium

An approximate list of evaluation tools

Table 2

№	Name of the evaluation tool	Brief description of the evaluation tool	Presentation of an evaluation tool in the fund
1.	Colloquium	A means of controlling the assimilation of educational material of a topic, section or sections of a discipline, organized as an educational activity in the form of an interview between a teacher and students	Questions on topics/sections of the discipline
2.	Interview (survey)	A control tool organized as a special conversation between the teacher and the student on topics related to the discipline being studied, and designed to clarify the amount of knowledge of the student on a specific section, topic, problem, etc.	Questions on the topics/sections of the discipline presented in relation to the competencies provided for in the RAP
3.	Test	A system of standardized tasks that allows you to automate the procedure	The fund of test tasks

2. INDICATORS AND CRITERIA FOR ASSESSING COMPETENCIES AT VARIOUS STAGES OF THEIR FORMATION, DESCRIPTION OF ASSESSMENT SCALES

Table 3

Planned results of competence development	The level of development				**Evaluation tool**
	Unsatisfactory	satisfactory	good	excellent	
GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results.					
GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity.	The level of knowledge is below the minimum requirements, gross errors have occurred	The minimum acceptable level of knowledge, many blunders have been made	The level of knowledge in the volume corresponding to the training program, several gross mistakes were made	The level of knowledge in the volume corresponding to the training program, without errors.	Colloquium, interview (survey), tests
GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained.	The level of knowledge is below the minimum requirements, gross errors have occurred	Basic skills have been demonstrated, typical tasks with minor errors have been solved, all tasks have been completed, but not in full	All the basic skills have been demonstrated, all the main tasks with minor errors have been solved, all tasks have been completed in full, but some with flaws	All basic skills have been demonstrated, all basic tasks have been solved with some minor flaws, and all tasks have been completed in full	Colloquium, interview (survey), tests
GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.	Basic skills were not demonstrated when solving standard tasks, and gross errors occurred	There is a minimal set of skills for solving standard tasks with some shortcomings	Basic skills are demonstrated in solving standard tasks with some shortcomings	Demonstrated skills in Solving non -standard tasks without errors and shortcomings	Colloquium, tests

3. THE LIST OF CONTROL TASKS AND OTHER MATERIALS NECESSARY FOR THE ASSESSMENT OF KNOWLEDGE, SKILLS, SKILLS AND WORK EXPERIENCE

3.1. Typical tasks for current academic performance monitoring

3.1.1. Questions for the colloquium

Questions for competence assessment:
GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results.
GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity.
GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained.
GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.

Section 1. Cytology

According to the Cytology section:

1. The subject and tasks of modern cytology. The importance of cytology as a fundamental and applied science for biology and medicine. Signs inherent in the living.
2. The emergence and development of cytology as a science. The importance of cellular theory. The main provisions of the cellular theory.
3. Histological and cytological research methods. The main stages of preparation of a histological preparation. Methods and techniques of microscopy.
4. Phase contrast microscopy. Fluorescence microscopy.
5. Electron microscopy. The method of autoradiography.
6. Immunological methods: monoclonal antibody method, immunofluorescence analysis.
7. General principles of the structural and functional organization of the cell.
8. Characteristics of prokaryotic cells.
9. Characteristics of eukaryotic cells.
10. The role of biomembranes in the organization of cellular structures.
11. The principle of the structure of biomembranes.
12. Quantitative characteristics and basic properties of membranes.
13. Intracellular membranes. Structure and functions
14. Plasma membrane. Structure and functions.
15. Receptors and transmembrane signal transmission.
16. Membrane transport of substances: active, passive, lightweight
17. Membrane transport of substances: endocytosis and exocytosis.
18. Organization and functions of the cytoskeleton.
19. Microtubules. Functions, location, formation and destruction.
20. Microfilaments. Intermediate filaments. Microvilli.
21. Contacts of a simple type. Building. Functions.
22. Coupling type contacts. Building. Functions.
23. Locking type contacts. Building. Functions.
24. Communication type contacts. Building. Functions.
25. Plasmodesmus of plants. Building. Functions.
26. DNA biosynthesis in prokaryotic cells.
27. DNA biosynthesis in eukaryotic cells.
28. Biosynthesis of RNA in prokaryotic cells.
29. Biosynthesis of RNA in eukaryotic cells.
30. Protein biosynthesis in prokaryotic cells.

31. Protein biosynthesis in eukaryotic cells.
32. Inclusions. Classification. The value of inclusions.
33. Granular endoplasmic reticulum. Building. Functions.
34. Agranular endoplasmic reticulum. Building. Functions.
35. The Golgi Complex. Building. Functions. Transport of substances in the Golgi complex.
36. Mitochondria. The structure and functions of mitochondria. Respiration and aerobic energy recovery. The growth and reproduction of mitochondria.
37. Lysosomes. Endosomes. Peroxisomes. Structure and functions.
38. The cellular vacuole of plants. Structure and functions.
39. The nucleus of the cell. Core components. The nuclear envelope. Structure and functions.
40. Chromatin. Chromatin packing levels. Chromosomes. Structure and functions.
41. Nucleoli. The nuclear matrix. Nuclear juice. Structure and functions.
42. Characteristics of the cell cycle. Differentiation of cells in the process of growth and development.
43. Growth factors. Growth inhibiting factors. Characteristic. Classification.
44. Mitosis. Amitosis. Biological significance.
45. Meiosis. Biological significance.

Section 5. Muscle tissue
1. The development of muscle tissue.
2. The structure of muscle tissue.
3. Classification of muscle tissue
4. Smooth muscle tissue
5. Myocyte, structure, functions.
6. Muscle fiber, structure.
7. Contractile apparatus.
8. Skeletal muscle system.
9. Muscle as an organ.
10. Muscle functions.

Section 7. Organs of the nervous system
1. Development and classification of nervous tissues of the central nervous system and PNS.
2. Characteristics of neurons.
3. Classification of neurons.
4. Glia of the central nervous system and PNS.
5. Nerve endings.
6. Structural features of myelin-free fibers.
7. Structural features of myelin fibers.
8. The autonomic nerve. system
9. Features of the structure and function of the central nervous system organs: spinal cord, cerebral cortex, cerebellum.
10. Types of reflex arcs.

Section 10. Organs of hematopoiesis and immunogenesis
1. Organs of hematopoiesis and immune protection.
2. Morphofunctional characteristics of the central organs of hematopoiesis.
3. Morphofunctional characteristics of peripheral hematopoiesis organs
4. Morphofunctional characteristics of the spleen.
5. Morphofunctional characteristics of lymph nodes.
6. Thymus and its role in immunogenesis, development, age and accidental involution.

Section 14. Organs of the excretory system.

1. Phylogeny and ontogenesis of the excretory organs.
2. The structure of the kidney.
3. Blood circulation of the kidney.
4. Histophysiology of the nephron.
5. The ureter
6. The bladder.
7. Filtration barrier

Section 16. Leather and its derivatives.
1. Skin and its derivatives.
2. The structure of the hair.
3. Hair development and change.
4. The structure of the hoof wall.
5. The structure of the breast
6. The structure of sweat glands, their classification.
7. The structure of the sebaceous glands
8. Skin functions.

3.1.2. Questions for the survey:

Questions for competence assessment:

GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results.

GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity.

GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained.

GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.

According to the section Epithelial tissues:

Epithelial tissues: general characteristics, genetic and morphological classification, location. Single-layer integumentary epithelium: classification, features of structure and functions. Multilayer integumentary epithelium: classification, features of structure and functions. Location in the body.

According to the section Musculoskeletal and trophic tissues:

General characteristics and classification of a group of connective tissues. Mesenchyme. Blood: composition, classification of shaped elements, features of their structure and functions. Erythrocytes: structural features, function, erythrocytopoiesis. Leukocytes: classification, structure and functions. A leukogram. Lymphocytes: morphological and immunological classification, features of functions in the immune response. Granulocytes of the red bone marrow, classification, structure and functions. Blood platelets and platelets, structure and functions. The structure and functions of connective tissues with special properties. Loose connective tissue: features of structure and function. Features of the structure and functions of cells of loose connective tissue. Dense decorated connective tissues: classification, structural features and functions. Cartilage tissues: general characteristics, classification, features of structure and functions. Bone tissue: general characteristics, classification. Features of the structure of a compact bone. Features of osteohistogenesis of flat and tubular bones.

According to the section Nervous tissue:

Nerve tissues: characteristics, classification and development of the main components, functions. Neurons: classification, structural features and functions. Neuroglia: classification, development of CNS and PNS glia, structure and functions. Types of nerve endings. Ultrastructural organization of the synapse. The structure of the nerve fibers of the central nervous

system and the PNS. The structure and functional significance of spinal ganglia. The spinal cord and its connection with other parts of the nervous system. The structure and connection of the cerebral cortex with the spinal cord. The structure, meaning and connection of the cerebellum with the spinal cord. The autonomic department of the nervous system. Features of reflex arcs of the sympathetic and parasympathetic systems.

According to the section of the endocrine gland:

Development, structure and function of the pituitary gland. The development, structure and function of the thyroid and parathyroid glands. The development, structure and function of the adrenal glands. The structure and function of the hypothalamus. Hypothalamic-pituitary-adrenal system.

According to the section Organs of the digestive system:

Classification and structural features of salivary glands. The structure of the language. The organ of taste. The structure and development of teeth. Features of the structure of the esophagus of pets. Features of the structure and function of the pre-ventricles of ruminants. The glandular part of the stomach. Fundal glands: features of structure and function. The structure of the wall of the small intestine. Features of the structure of the duodenum. Features of the structure of the colon wall. The structure, functions and features of the blood supply to the liver. The structure of the exo- and endocrine parts of the pancreas, functions.

According to the section Organs of the respiratory system:

Features of the structure of the trachea and walls of the bronchial tree. The structure of the lung. The structure of the alveoli. The aerogematic barrier.

According to the section Organs of the excretory system:

The structure, functions and features of the blood supply to the kidneys. Histophysiology of the nephron. Features of the structure of cells of various departments. Juxtaglomerular complex.

According to the section, the reproductive system of males and females:

Testis: development, structure, functions. Ovary: development, structure, functions.Maturation of follicles in the ovary and atresia. The development, structure and functions of the ovarian corpus luteum. The structure of the oviduct and uterus during the sexual cycle. Placenta: features of the placental barrier in different animals. Anatomical and histological classification of placentas.

3.1.3. Tests

Questions for competence assessment:

GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results.

GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity.

Section 1. Cytology

1. Specify the types of lysosomes according to their classification:
a) liposome
b) secondary
c) residual body
d) primary
2. Specify the sequence of phases of mitosis:
a) telophase – anaphase – metaphase - prophase
b) prophase – anaphase – telophase – metaphase
c) prophase – metaphase – anaphase – telophase
d) telophase – prophase – anaphase – metaphase
3. The following structures can be found in the mitochondria:

a) crypts
b)crystals c) ribosomes
d) microtubules
4. Intermediate filaments provide the following functions:
a) wall digestion
b) synthesis of NADP
c) movement
d) support-frame function
5. The cytoskeleton of the cell, including this organelle, forms:
a) a thin microfilament
b) mitochondria
c) lysosome
d) peroxisome

Section 2. Embryology

1. During capacitation, there is:
a) the release of enzymes from spermatozoa
b) the formation of a fertilization shell
c) the loss of a flagellum by spermatozoa
d) an increase in the number of mitochondria in spermatozoa
e) activation of spermatozoa
2. Crushing of the bird embryo:
a) complete uniform
b) complete uneven
c) partial asynchronous
d) complete uniform asynchronous
e) complete non-uniform asynchronous
3. The embryonic beginnings of the neural tube are differentiated from:
a) the ventral mesoderm
b) endoderms
c) dorsal mesoderm
d) endoderms and mesoderms
e) dorsal ectoderm
4. The cortical granules of the egg are involved in:
a) accumulation of nutrients
b) the start of zygote crushing
c) facilitating the penetration of sperm into the egg
d) ensuring contact with the sperm
e) formation of the fertilization shell
5. The embryonic epiblast includes all the listed rudiments:
a) the neural plate
c) chord
b) mesoderm
d) primary nodule
e) chorion

Section 5. Muscle tissue
1. Smooth muscle tissue of neural origin includes:
a) the muscle that stretches the eardrum
b) oculomotor muscles
c) ciliary muscle

d) eyelid lifting muscle
e) muscles constricting and dilating the pupil
2. Cardiac muscle tissue belongs to the following histogenetic type:
a) mesenchymal
b) epidermal
c) neural d) somatic
e) coelomic
3. The transmission of a contraction pulse from one cardiomyocyte to another is carried out through:
a) desmosomes
b) tight contacts
c) synapses
d) simple contacts
e) slot contacts (nexuses)
4. A sarcomere is a section of myofibrils between:
a) mesophragmas
b) H-bands
c) A-disks d) I-disks
e) telofragmas (Z-disks)
5. T-tubes of muscle fibers are:
a) EPS channels
b) microtubules of the cytoskeleton
c) granular EPS tanks
d) cisterns of the sarcoplasmic network
e) depressions (invaginations) of the sarcolemma of the muscle fiber

Section 7. Organs of the nervous system
1. After traumatic compression of a limb, degeneration of nerve fibers is detected in its nerve, which is accompanied by:
a) disintegration of the endings of nerve fibers
b) destruction of myelin
c) tigrolysis
d) phagocytosis of fragments of damaged nerve fibers
e) death of Schwann cells in the distal segment
2. The biochemical classification of neurons includes:
a) cholinergic
b) serotonergic
c) adrenergic
d) dopaminergic
e) estrogenergic
3. The structure of myelin nerve fibers is characterized by:
a) one axial cylinder
b) nodal interceptions
c) neurofilaments
d) lemmocytes
e) several axial cylinders
4. Chemical synapses are composed of:
a) postsynaptic membrane
b) the presynaptic membrane
c) the synaptic cleft
d) synaptic vesicles
e) oligodendrogliocytes

5. In an experiment on embryos, the neural crest was removed. The genesis of the following tissue elements is disrupted:
a) sensitive neurons of spinal nodes
b) neurons of sympathetic ganglia
c) chromaffin cells
d) melanocytes
e) motor neurons of the spinal cord
Section 10. Organs of hematopoiesis and immunogenesis
1. Differentiation of T-lymphocytes occurs in the thymus under the action of:
a) colony stimulating factors
b) transforming growth factors
c) prostaglandins
d) interleukins
e) thymosin
2. The first stage of embryonic hematopoiesis occurs in:
a) red bone marrow
b) liver
c) thymus
d) lymph
nodes e) mesenchyme of the yolk sac
3. Postembryonic myelopoiesis occurs in:
a) the thymus
b) liver
c) lymph nodes d) spleen
e) red bone marrow
4. Blood plates are formed from:
a) polychromatophilic erythroblast
b) myelocytes
c) reticulocytes
d) endotheliocytes
e) megakaryocytes
5. The thymus develops from:
a) ectoderm
b) mesoderms
c) dermatome
d) mesenchyma
e) endoderm of the 3rd pharyngeal pocket

GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained.

Section 1. Cytology
1. Find a match. Specify the structure that fits the concept of a membrane organelle:
a) ribosome
b) mitochondria
c) centriole
d) the core
2. Find a match. Specify the structures that fit the concept of a non-membrane organelle:
a) microtubule
b) trophic granule
c) the nucleus
d) centriole

3. Find a match. Specify the structure that fits the concept of a membrane organelle:
a) granular EPS
b) trophic granule
c) the nucleolus
d) the intermediate filament
4. Give a classification definition of the Golgi complex. This is:
a) a membrane-type organelle
b)non-membrane type organelle c) special type organelle
d) specialized cytomembrane structure
5. Specify the correct sequence of the initial stages of meiosis I:
a) pachinema – diplonema – zygonema – leptonema
b) pachinema – zygonema – diplonema – leptonema
c) leptonema – pachynema – diplonema – zygonema
d) leptonema – zygonema – pachynema – diplonema
Section 2. Embryology
1. The embryonic source of bone tissue is:
a) the dermat of somites (mesoderm)
b) splanchnotome (mesoderm)
c) myote of somites (mesoderm)
d) endoderm
e) sclerotomy of somites (mesoderm)
2. Myotomes of mesoderm somites develop:
a) smooth muscle tissue
b) cardiac muscle tissue
c) myoepithelial cells
d) muscles of the iris
e) skeletal muscle tissue
3. Fertilization of a mammalian egg occurs in:
a) the abdominal cavity
b) uterine cavities
c) the isthmic part of the uterus
d) areas of the cervix
e) the ampullary part of the oviduct
4. Secondary fragmentation of the oligolecital egg of placentals
ends with the formation of:
a) discoblastula
b) a single-layer blastula
c) morula d) gastrula
e) blastocysts
5. The chorion in mammals consists of:
a) extra-embryonic ectoderm
b) extra-germinal endoderm
c) ectoderm and parietal leaf of extra-germinal mesoderm
d) endoderm and visceral leaf of extra-germinal mesoderm
e) trophoblast and extra-germinal mesoderm

Section 7. Organs of the nervous system
1. Synapses of a chemical type are characterized by a neurotransmitter:
a) norepinephrine
b) acetylcholine
c) serotonin

d) dopamine
e) bradykinin
2. Unidirectional conduction of a nerve impulse in the synapse area defined by:
a) the system of neurofilaments and neurotubules
b) the presence of mitochondria
c) axoplasmic flow of substances
d) the presence of actin, myosin filaments
e) the presence of synaptic vesicles in the postsynaptic pole
3. Oligodendrocytes by their location:
a) surround the bodies of nerve cells in the central nervous system
b) surround the bodies of nerve cells in the peripheral nervous system
c) they are part of the membranes of nerve fibers
d) they are part of the white matter of the spinal cord
e) lining the cavities of the ventricles of the brain and the spinal canal
4. Oligodendrocytes are characterized by:
a) oval or angular shape
b) the presence of several short non-branching
processes c) small size compared to the size of neurons
d) electron-dense cytoplasm
e) the presence of neurofilaments
5. Microglyocytes are characterized by:
a) promonocytic bone marrow origin
b) small size and process shape
c) elongated or triangular nuclei rich in chromatin
d) transformation into granular balls upon irritation
e) participation in the absorption and metabolism of neurotransmitters

Section 10. Organs of hematopoiesis and immunogenesis
1. Which cells are involved in transplant rejection?
a) macrophages
b) T-helpers
c) T-suppressors
d) B lymphocytes
e) T-killers
2. The paracortical zone of the lymph node is formed by the following cells:
a) B-lymphocytes
b) plasmocytes
c) macrophages
d) leukocytes-granulocytes
e) T-lymphocytes and interdigitating cells
3. In the cerebral strands of lymph nodes, there is:
a) accumulation of antigens on the surface of macrophages
b) proliferation and maturation of T-lymphocytes
c) proliferation and maturation of interdigitating cells
d) deposition of stem cells
e) proliferation of B-lymphocytes and differentiation of plasmocytes
4. The white pulp of the spleen is represented by:
a) strands of leukocytes
b) cerebral strands
c) strands of erythrocytes
d) sedentary macrophages
e) lymph nodes

5. In the red pulp of the spleen, most of the cells are represented:
a) T-lymphocytes
b) B-lymphocytes
c) interdigitating cells
d) plasmocytes
e) erythrocytes and macrophages

GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.

Section 1. Cytology
1. Microtubules provide the following functions:
a) cyclosis
b) synthesis of mucopolysaccharides
c) form the basis of microvilli
d) it is a part of myofibrils
2. The intermediate microfilament is:
a) a membrane-type organelle
b) a non-membrane type organelle
c) a special type organelle
d) by turning on
3. Types of mitochondria that are typical for mammals:
a) filamentous
b) reticular
c) multivesicular
d) trabecular
4. Mark the structures that are revealed in the mitochondria:
a) matrix
b) cyclic DNA
c) double-layered membrane
d) two double-layer membranes
5. Specify the structure that fits the concept of inclusion:
a) peroxisome
b) lysosome
c) centriole
d) secretory granule

Section 2. Embryology
1. The main source of smooth muscle tissue development is:
a) myote of somites
b) nephrotome
c) intestinal endoderm
d) ectoderm
e) mesenchyme
2. Dermatomes of mesoderm somites form**:**
a) skin epithelium
b) hair, nails
c) salivary glands
d) mammary gland
e) connective tissue base of the skin
3. Specify the correct alternation of the main stages of embryogenesis:
a) zygote – gastrula – blastocyst – organogenesis

b) fragmentation – gastrula – blastocyst – organogenesis
c) morula – blastocyst – organogenesis – gastrula - histogenesis
d) blastocyst – morula – gastrula – histogenesis - organogenesis
e) zygote – morula – blastocyst – gastrula – histo- and organogenesis
4. The trophoblast is an integral part of:
a) epiblast
b) internal cell mass
c) hypoblast
d) morula
e) blastocysts
5. From the dorsal primary ectoderm are formed:
a) sweat glands
b) hair
c) the epithelium of the kidney
d) uterine epithelium
e) spinal cord

Section 5. Muscle tissue
1. T-tubes perform the following function:
a) participate in protein synthesis
b) transport
c) provides a connection between myofibrils
d) energy
e) ensures that the pulse is carried deep into the muscle fiber
2. Arbitrary abbreviations are typical for:
a) cardiac muscle tissue
b) myoepithelial cells
c) smooth muscle tissue
d) myoneural cells
e) skeletal muscle tissue
3. What is typical for the membranes of the sarcoplasmic reticulum tanks – Ca2+ depot:
a) an analogue of the membranes of the granular endoplasmic reticulum
b) contains a pump pumping Ca2+ out of the tank
c) the Ca2+ channel interacts with a receptor associated with the G protein
d) the concentration of Ca2+ in the cytosol does not affect the state of the Ca2+ channels
e) through the Ca2+ channels, ions enter the cytosol along a concentration gradient
4. If the structural unit of the tissue is a simplast, then this is muscle tissue:
a) coelomic c) neural
b) mesenchymal d) ectodermal
e) somatic
5. The proteins of myofibrils do not include:
a) actin c) myosin
b) troponin d) tropomyosin
e) myoglobin

Section 7. Organs of the nervous system
1. Fibrous astrocytes are characterized by:
a) located in the white matter of the brain
b) have 20-40 long thin processes
c) form perivascular glial boundary membranes
d) the presence of bundles of glial fibrils in the cytoplasm
e) participation in the transmission of an impulse from one neuron to another

2. The following parts are distinguished as part of the effector neuron:
a) the pericarion
b) axon and dendrites
c) interneuronal nerve endings
d) effector nerve endings
e) receptor nerve endings
3. The following parts are distinguished as part of a sensitive neuron:
a) the pericaryon
b) axon and dendrites
c) interneuronal nerve endings
d) receptor nerve endings
e) effector nerve endings
4. The ultrastructure of the cytoplasm of neurons is characterized by the presence of:
a) well-developed granular EPS
b) Golgi complex
c) mitochondria with poorly developed
crystals d) neurotubules and neurofilaments
e) networks of vimentin filaments
5. Receptor nerve endings include:
a) free nerve endings
b) non-free non-encapsulated nerve endings
c) lamellar corpuscles
d) neuromuscular spindles
e) motor plaques

3.2. Typical tasks for intermediate certification

3.2.1. Questions for the test

Emerging competencies:

GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results.
GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity.
GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained.
GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.

1. The technique of taking, fixing and compacting the material for histological examination.
2. The technique of making histocuts, their coloring and conclusion.
3. Modern methods (cytochemistry, histoautoradiography, luminescent and electron microscopy) of research.
4. The structure of the cell as a self-regulating system of the body.
5. Ultrastructural organization of the cell surface apparatus, role in the realization of cellular functions.
6. Ultrastructural organization and interrelationships of organelles of the metabolic apparatus of the cell.
7. Ultrastructural organization of cell membrane organelles, their role.
8. Ultrastructural organization of non-membrane cell organelles, their role.
9. The hereditary apparatus of the cell: the structure and function of the nucleus throughout the cell cycle.
10. Karyotype. Mitotic chromosomes, morphology, chemical composition.

11. The mitotic cycle of the cell, its course and biological essence.
12. Microscopic and ultrastructural organization of sperm cells.
13. Spermatogenesis, its features and essence.
14. Features of the structure of eggs.
15. Ovogenesis, its course and features.
16. Meiosis, its course and biological essence.
17. Principles of egg classification. Features of zygote crushing.
18. The main periods of embryonic development.
19. Features of the early stages of embryonic development of the lanceolate.
20. Features of the early stages of embryonic development of amphibians.
21. Features of the early stages of embryonic development of birds.
22. Features of the early stages of mammalian embryonic development.
23. Development and significance of extra-germ shells of birds and mammals.
24. Formation and differentiation of the mesoderm.
25. Embryonic sources of tissue and organ formation.
26. Definition of the concept of fabric. Morphofunctional and genetic classification of tissues.
27. Epithelial tissues: general characteristics, genetic and morphological classification, location.
28. Single-layer integumentary epithelium: classification, features of structure and functions. Location in the body.
29. Multilayer integumentary epithelium: classification, features of structure and functions. Location in the body.
30. General characteristics and classification of a group of connective tissues. Mesenchyme.
31. Blood: composition, classification of shaped elements, features of their structure and functions.
32. Erythrocytes: structural features, function, erythrocytopoiesis.
33. Leukocytes: classification, structure and functions. A leukogram.
34. Lymphocytes: morphological and immunological classification, features of functions in the immune response.
35. Granulocytes of the red bone marrow, classification, structure and functions.
36. Blood platelets and platelets, structure and functions.
37. The structure and functions of connective tissues with special properties.
38. Loose connective tissue: features of structure and function.
39. Features of the structure and functions of cells of loose connective tissue.
40. Dense decorated connective tissues: classification, structural features and functions.
41. Cartilaginous tissues: general characteristics, classification, features of structure and functions.
42. Bone tissue: general characteristics, classification. Features of the structure of a compact bone.
43. Features of osteohistogenesis of flat and tubular bones.
44. Smooth muscles: features of structure, development and location.
45. Skeletal striated muscles: structure, development and functions.

3.2.2. Exam questions

Emerging competencies:

GPC-4. Is able to use methods to solve problems, using modern equipment for the development of new technologies in professional activity and use modern professional methodology to conduct experimental research and interpret the results.

GPC-4 ID-1 To know: the technical capabilities of modern specialized equipment, methods of problems resolution in professional activity.

GPC-4 ID-2 To be able to: apply modern technologies and research methods in professional activities, interpret the results obtained.

GPC-4 ID-3 To possess skills of: the work with specialized equipment for implementation of the set tasks for research and the development of new technologies, digital ones, as well.

1. The technique of taking, fixing and compacting the material for histological examination.

2. The technique of making histocuts, their coloring and conclusion.
3. The importance of new research methods (cytochemistry, histoautoradiography, luminescent and electron microscopy) for understanding the deep processes of life at the cellular and subcellular levels.
4. The structure of the cell as a self-regulating system of the body.
5. Ultrastructural organization of the cell surface apparatus, role in the realization of cellular functions.
6. Ultrastructural organization and interrelationships of organelles of the metabolic apparatus of the cell.
7. Ultrastructural organization of cell membrane organelles, their role.
8. Ultrastructural organization of non-membrane organelles of the cell, their role.
9. Hereditary apparatus of the cell: structure and function of the nucleus throughout the cell cycle.
10. Karyotype. Mitotic chromosomes, morphology, chemical composition.
11. Nucleic acids, their role, methods of detection and localization in the cell. Protein biosynthesis.
12. The mitotic cycle of the cell, its course and biological essence.
13. Microscopic and ultrastructural organization of sperm cells.
14. Spermatogenesis, its features and essence.
15. Features of the structure of eggs.
16. Ovogenesis, its course and features.
17. Meiosis, its course and biological essence.
18. Fertilization and its features in mammals.
19. Principles of egg classification. Features of zygote crushing.
20. The main periods of embryonic development.
21. Features of the early stages of embryonic development of the lanceolate.
22. Features of the early stages of embryonic development of amphibians.
23. Features of the early stages of embryonic development of birds.
24. Features of the early stages of mammalian embryonic development.
25. Development and significance of extra-germ shells of birds and mammals.
26. Formation and differentiation of the mesoderm.
27. Embryonic sources of tissue and organ formation.
28. Definition of the concept of fabric. Morphofunctional and genetic classification of tissues.
29. Epithelial tissues: general characteristics, genetic and morphological classification, location.
30. Single-layer integumentary epithelium: classification, features of structure and functions. Location in the body.
31. Multilayer integumentary epithelium: classification, features of structure and functions. Location in the body.
32. General characteristics and classification of a group of connective tissues. Mesenchyme..
33. Blood: composition, classification of shaped elements, features of their structure and functions.
34. Erythrocytes: structural features, function, erythrocytopoiesis.
35. Leukocytes: classification, structure and functions. A leukogram..
36. Lymphocytes: morphological and immunological classification, features of functions in the immune response.
37. Granulocytes of the red bone marrow, classification, structure and functions.
38. Blood platelets and platelets, structure and functions.
39. The structure and functions of connective tissues with special properties.
40. Loose connective tissue: features of structure and function.
41. Features of the structure and functions of cells of loose connective tissue.
42. Dense decorated connective tissues: classification, structural features and functions..
43. Cartilaginous tissues: general characteristics, classification, features of structure and functions.
44. Bone tissue: general characteristics, classification. Features of the structure of a compact bone.
45. Features of osteohistogenesis of flat and tubular bones.
46. Smooth muscles: features of structure, development and location.

47. Skeletal striated muscles: structure, development and functions..
48. Cardiac striated muscle tissue: structural features of typical and atypical muscles.
49. Nerve tissues: characteristics, classification and development of the main components, functions.
50. Neurons: classification, structural features and functions.
51. Neuroglia: classification, development of CNS and PNS glia, structure and functions.
52. Types of nerve endings. Ultrastructural organization of the synapse.
53. The structure of the nerve fibers of the central nervous system and the PNS.
54. The structure and functional significance of spinal ganglia.
55. The spinal cord and its connection with other parts of the nervous system.
56. The structure and connection of the cerebral cortex with the spinal cord.
57. The structure, meaning and connection of the cerebellum with the spinal cord..
58. The autonomic department of the nervous system. Features of reflex arcs of the sympathetic and parasympathetic systems.
59. Eyeball: development, structure of membranes. The receptor apparatus.
60. The structure of the inner ear: the cortical organ, macules, and crystals.
61. The structure of the vascular wall of the hemomicrocirculatory bed, functions.
62. Features of the structure of arteries and veins of various calibers in connection with hemodynamic conditions.
63. The development and structure of the heart wall. The conductive system of the heart.
64. Thymus: development, structure, function. Age-related and accidental involution of the organ.
65. Lymph nodes: development, structure, functions. Localization of T- and B-lymphocyte populations.
66. Features of the structure and functions of the spleen.
67. Morphofunctional features of the red bone marrow.
68. Development, structure and function of the pituitary gland.
69. Development, structure and function of the thyroid and parathyroid glands.
70. Development, structure and function of the adrenal glands.
71. The structure and function of the hypothalamus. Hypothalamic-pituitary-adrenal system.
72. Classification and structural features of salivary glands.
73. The structure of the language. The organ of taste.
74. The structure and development of teeth.
75. Features of the structure of the esophagus of domestic animals.
76. Features of the structure and function of the pre-ventricles of ruminants.
77. The glandular part of the stomach. Fundal glands: features of structure and function.
78. The structure of the wall of the small intestine. Features of the structure of the duodenum.
79. Features of the structure of the colon wall.
80. The structure, functions and features of the blood supply to the liver.
81. The structure of the exo- and endocrine parts of the pancreas, functions.
82. Structural features of the trachea and walls of the bronchial tree.
83. The structure of the lung. The aerogematic barrier.
84. The structure, functions and features of blood supply to the kidneys.
85. Histophysiology of the nephron. Features of the structure of cells of various departments. Juxtaglomerular complex.
86. Testis: development, structure, functions.
87. Ovary: development, structure, functions.
88. Maturation of follicles in the ovary and atresia. The development, structure and functions of the ovarian corpus luteum.
89. The structure of the oviduct and uterus during the sexual cycle.
90. Placenta: features of the placental barrier in different animals. Anatomical and histological classification of placentas.
91. The development, structure and functional significance of the skin.
92. The development, structure and change of hair. The glands of the skin.

93. The development and structural features of the mammary gland under the influence of pituitary and ovarian hormones. Morphology of milk secretion.
94. Development and structure of the hoof wall

4. METHODOLOGICAL MATERIALS DEFINING THE PROCEDURES FOR ASSESSING KNOWLEDGE, SKILLS AND ABILITIES AND WORK EXPERIENCE CHARACTERIZING THE STAGES OF COMPETENCE FORMATION

Criteria for evaluating students' knowledge during the colloquium:

• **Mark "excellent"** - the student clearly expresses his point of view on the issues under consideration, giving appropriate examples.
• **Mark "good"** - the student admits some errors in the answer
• **Mark "satisfactory**" - the student discovers gaps in knowledge of the basic educational and normative material.
• **Mark "unsatisfactory"** - the student discovers significant gaps in knowledge of the basic provisions of the discipline, inability to get the correct solution to a specific practical problem with the help of a teacher.

Criteria for evaluating students' knowledge during an interview:

• **Mark "excellent**" - the student clearly expresses his point of view on the issues under consideration, giving appropriate examples.
• **Mark "good"** - the student admits some errors in the answer
• **Mark "satisfactory"** - the student discovers gaps in knowledge of the basic educational and normative material.
• **Mark "unsatisfactory"** - the student discovers significant gaps in knowledge of the main provisions of the discipline.

Criteria for evaluating students' knowledge during testing:

The test result is evaluated on a percentage rating scale. Each student is offered a set of test tasks of 25 questions:
• **Mark "excellent"** – 25-22 correct answers.
• **Mark "good"** – 21-18 correct answers.
• **The mark "satisfactory"** is 17-13 correct answers.
• **Mark "unsatisfactory"** – less than 13 correct answers

Criteria of knowledge during the test:
• **The grade "credited"** must correspond to the parameters of any of the positive grades ("excellent", "good", "satisfactory").
• **The grade "not credited"** must correspond to the parameters of the grade "unsatisfactory".
• **Mark "excellent"** – all types of educational work provided for in the curriculum have been completed. The student demonstrates the compliance of knowledge, skills, and abilities with the indicators given in the tables, operates with acquired knowledge, skills, and applies them in situations of increased complexity. At the same time, inaccuracies, difficulties in analytical operations, transfer of knowledge and skills to new, non-standard situations may be allowed.
• **Mark "good"** – all types of educational work provided for in the curriculum have been completed. The student demonstrates the compliance of knowledge, skills, and abilities with the indicators given in the tables, operates with acquired knowledge, skills, and applies them in

standard situations. At the same time, minor errors, inaccuracies, difficulties in analytical operations, transfer of knowledge and skills to new, non-standard situations may be made.

• **Mark "satisfactory"** – one or more types of educational work provided for in the curriculum have not been completed. The student demonstrates incomplete compliance of knowledge, skills, and abilities with the indicators given in the tables, significant errors are made, a partial lack of knowledge, skills, and skills is manifested in a number of indicators, the student experiences significant difficulties in operating with knowledge and skills when transferring them to new situations. –

• **Mark "unsatisfactory"** – the types of educational work provided for in the curriculum have not been completed. demonstrates incomplete compliance of knowledge, skills, and abilities given in the tables of indicators, significant errors are made, a lack of knowledge, skills, and skills is manifested for a large number of indicators, the student experiences significant difficulties in operating knowledge and skills when transferring them to new situations

Criteria of knowledge during the examination:

• **Mark "excellent"** – all types of educational work provided for in the curriculum have been completed. The student demonstrates the compliance of knowledge, skills, and abilities with the indicators given in the tables, operates with acquired knowledge, skills, and applies them in various situations of increased complexity. At the same time, inaccuracies, difficulties in analytical operations, transfer of knowledge and skills to new, non-standard situations may be allowed. –

• **Mark "good"** – all types of educational work provided for in the curriculum have been completed. The student demonstrates the compliance of knowledge, skills, and abilities with the indicators given in the tables, operates with acquired knowledge, skills, and applies them in standard situations. At the same time, minor errors, inaccuracies, difficulties in analytical operations, transfer of knowledge and skills to new, non-standard situations may be made.

• **Mark "satisfactory"** – one or more types of educational work provided for in the curriculum have not been completed. The student demonstrates incomplete compliance of knowledge, skills, and abilities with the indicators given in the tables, significant errors are made, a partial lack of knowledge, skills, and skills is manifested in a number of indicators, the student experiences significant difficulties in operating with knowledge and skills when transferring them to new situations. –

• **Mark "unsatisfactory"** – the types of educational work provided for in the curriculum have not been completed. demonstrates incomplete compliance of knowledge, skills, and abilities given in the tables of indicators, significant errors are made, a lack of knowledge, skills, and skills is manifested for a large number of indicators, the student experiences significant difficulties in operating with knowledge and skills when transferring them to new situations.

5. ACCESSIBILITY AND QUALITY OF EDUCATION FOR PEOPLE WITH DISABILITIES

If necessary, persons with disabilities and persons with disabilities are given additional time to prepare an answer for the test.

When conducting the procedure for evaluating the learning outcomes of people with disabilities and persons with disabilities, their own technical means can be used.

The procedure for evaluating the learning outcomes of persons with disabilities and persons with disabilities in the discipline provides for the provision of information in forms adapted to the limitations of their health and perception of information:

For people with visual impairments:	– in printed form in enlarged font,
For people with hearing impairments:	– in the form of an electronic document.

For people with disorders of the musculoskeletal system	– in printed form,

When conducting the procedure for evaluating the learning outcomes of persons with disabilities and persons with disabilities in the discipline, it ensures that the following additional requirements are met, depending on the individual characteristics of the students:

a) instructions on the procedure for conducting the assessment procedure are provided in an accessible form (orally, in writing);

b) an accessible form of assignment of assessment tools (in printed form, in printed form in enlarged font, in the form of an electronic document, assignments are read out by the teacher);

c) an accessible form of providing answers to tasks (written on paper, a set of answers on a computer, orally).

If necessary, for students with disabilities and the disabled, the procedure for evaluating the results of training in the discipline can be carried out in several stages.

The procedure for evaluating the learning outcomes of people with disabilities and persons with disabilities is allowed using distance learning technologies.