

Approved by  
Deputy Rector for Academic Affairs

\_\_\_\_\_ E.V. Konovalova

"16" June 2022, Record No.6

## HISTOLOGY, EMBRYOLOGY, CYTOLOGY

### Syllabus

Department **Pathophysiology and General Pathology**

Curriculum s310501-ЛечДелоИн-21-1.pli.xml  
Specialty 31.05.01 General Medicine

Qualification **General Practitioner**

Form of education **Full-time**

Total (in credits) **7**

Total academic hours	252	Control:
including:		Exam, 3 <sup>rd</sup> term
Classes	144	
Self-study	72	
Control hours	36	

### Course outline in terms

Academic year (Term)	1 (1.2)		2 (2.1)		Total	
	22		19			
Types of classes	Cur	Syl	Cur	Syl	Cur	Syl
Lectures	16	16	16	16	32	32
Practical	64	64	48	48	112	112
Self-study	64	64	8	8	72	72
Control hours	-	-	36	36	36	36
Total	144	144	108	108	252	252

The Syllabus is compiled by:

*PhD in Medical Sciences, Associate Professor, Khizhnyak A.S.* \_\_\_\_\_

The Syllabus

**Histology, embryology, cytology**

Developed in accordance with Federal State Educational Standard:

Federal State Educational Standard of higher education in the specialty 31.05.01 General medicine (Order of the Ministry of Education and Science of the Russian Federation on August, 12, 2020. №988)

Based on the Curriculum:

31.05.01 GENERAL MEDICINE

Specialization: General Medicine

Approved by the Academic Council of Surgut State University, “16” June 2022, Record No.6

The Syllabus was approved by the department

Pathophysiology and general pathology

Head of Department, Doctor of Medicine, Professor Kovalenko L.V.

## 1. COURSE OBJECTIVES

- 1.1 The **aim** of the course of histology, embryology, and cytology in higher medical schools is to master the knowledge of the microscopic functional morphology and development of the cellular, tissue and organ systems of the human body. It provides the basis for studying clinical disciplines and contributes to the formation of medical thinking.
- The **objectives** of mastering the discipline "Histology, embryology, cytology" are:
- to study general and specific structural and functional properties of body cells and tissues and their patterns of embryonic and post-embryonic development;
  - to study the histo-functional characteristics of main body systems, patterns of their embryonic development, as well as functional, age-related and protective-adaptive changes in organs and their structural elements;
  - to form students' skills in microscopic examination of histological specimens.

## 2. COURSE OVERVIEW

Course code (in curriculum) | B1.O.04.09

### 2.1 Assumed background:

For the study of histology, embryology, cytology, the student **must know**:

- the effect on the human body of biotic, abiotic and social factors, as well as human adaptation to the environment;
- properties of biological systems, anthropogenesis and ontogenesis of man, the main regularities of the evolutionary transformation of human organs and systems;
- basic medical and pharmaceutical terminology in Latin;
- classification of chemical elements by their quantitative content in the body, topography and biological role;
- the role of chemical elements in the body for the prediction, diagnosis and treatment of various diseases;
- the most common physical patterns underlying the processes occurring in the body;
- physical properties of some biological tissues and liquids;
- characteristics of physical factors that affect the body, biophysical mechanisms of such impact;
- the structure of the human body, making up its systems, organs and tissues
- the relationship and interdependence of individual parts of the body;
- mechanisms of functioning of organs and systems of the body, regulation of their functions, consequences of environmental factors;
- normal parameters of homeostasis;
- safety rules and work in biological laboratories with reagents, instruments, animals;
- The physical basis of the functioning of medical equipment;

#### **be able to:**

- explain the nature of deviations in the course of development leading to the formation of options, anomalies and vices;
- to conduct an assessment of the factors determining the health status of different age-and-sex groups of the population, in connection with the way of life and hereditary characteristics;
- handle laboratory equipment and reagents;
- prepare solutions of a certain concentration;
- take into account the influence of labour, physical culture and social conditions on the development and structure of the organism;
- to find and determine the position and projection of organs and their parts;
- evaluate the functions of human organs and systems;
- use computational tools to process the results;
- measurements, use computer technology and work on physical medical equipment;
- use educational, scientific and popular science literature, the Internet;
- work with magnifying equipment (light microscope);

#### **have skills of:**

- identification of different periods of ontogenesis at individual stages in each period;
- methods of microscopic analysis of biological objects;
- reading and writing skills in Latin for clinical and pharmaceutical terms;
- physico-chemical research methods used in medical practice;
- methods of qualitative analysis of organic substances;
- basic mechanical, thermophysical, electrical and optical measurements.

### 2.2 Post-requisite courses and practice:

Immunology and Allergiology
Pathologic Anatomy
Clinical Pathologic Anatomy
Dermatovenereology
Neurology, Medical Genetics, Neurosurgery
Otorhinolaryngology
Ophthalmology
Obstetrics

	Gynecology
	Paediatrics, Childhood Infections
	Hospital Therapy
	Endocrinology
	Dentistry
	Oncology, X-Ray Therapy
	Traumatology and Orthopedics
	Clinical Pathologic Anatomy
	Biochemistry
<b>3. COMPETENCES UPON COMPLETION OF THE COURSE (MODULE)</b>	
GPC-5.1: Knows the histological structure of organ tissues - knows how to differentiate them microscopically; the anatomy of the human body - the macroscopic structure and topography of organs and body parts; human physiology - the mechanisms of homeostasis regulation and the functional systems of the body in the normal condition	
GPC -5.2: Knows the structure of the cell, the phases of its division, the theoretical principles of genetics and the biology of insects and helminths, their role in the aetiology of human diseases	
GPC-5.6: Knows the structure of the human body, morphological macro- and microscopic parameters in health and in pathology, criteria for general pathological pathophysiological processes in various nosologies, knows how to differentiate them macro- and microscopically, has skills to solve problems of operative surgery on the basis of knowledge of topographic anatomy	
<b>By the end of the course students must:</b>	
<b>3.1</b>	<b>know:</b>
	safety and operating instructions for work in physical, chemical, biological laboratories with reagents, equipment, animals;
	chemical and biological essence of the processes occurring in a living organisms at the molecular, cellular, tissue and organ levels;
	the basic development and functioning patterns of the organisms on the basis of structural organization of their cells, tissues and organs;
	histo-functional peculiarities of tissue elements and their research methods;
	the structure, topography and development of cells, tissues, organs and systems of the organism in correlation with their function, peculiarities of the organismic and population life organization levels;
	functional systems of the human body, their regulation and self-regulation when exposed to the external environment;
	the structure and functions of the human immune system, its age-related peculiarities, cellular-molecular development and functioning mechanisms of the immune system, the main stages, types, genetic control of the immune response;
	microscopic structure, functions and sources of cell development;
	tissue and microscopic structure, functions and sources of organ development;
	the main stages of embryonic development and their characteristics;
	critical periods of human embryonic development;
	age-related peculiarities of tissue and organ structure.
<b>3.2</b>	<b>be able to:</b>
	use educational, scientific, popular scientific literature and the Internet for professional activity;
	use physical, chemical and biological equipment;
	work with magnifying equipment (microscopes, optical and simple lenses);
	make a histophysiology assessment of the state of various cellular, tissue and organ structures;
	explain the nature of the deviations in the development pattern which can lead to the variants of abnormalities and malformations;
	interpret the results of the most common functional diagnostics methods used to detect the pathology of blood, heart and blood vessels, lungs, liver, kidneys and other organs and systems.
	draw histological and embryological specimens and to designate the structural elements in them;
	examine histological and embryological specimens with the microscope;
	analyse histological and embryological specimens;
	examine electron microphotographs of cells and non-cellular structures;
	prepare oral and written description of the specimens;

	apply the knowledge of histology in practice for solving standard problems in the professional activity of a doctor (solving situational tasks).						
<b>3.3</b>	<b>have skills of:</b>						
	medical and anatomical conceptual framework;						
	microscopy and analysis of histological specimens and electron microphotographs;						
	making a preliminary diagnosis based on the results of human biological fluids biochemical studies;						
	working with a microscope and histological specimens;						
	reading scientific theme-based literature on histology and the ability to use it for abstracts and scientific reports.						
<b>4. STRUCTURE AND CONTENTS OF THE COURSE (MODULE)</b>							
<b>Class Code</b>	<b>Topics /Class type</b>	<b>Term / Academic year</b>	<b>Academic hours</b>	<b>Competences</b>	<b>Literature</b>	<b>Interactive</b>	<b>Notes</b>
	<b>Section 1. Cytology</b>						
<b>1.1</b>	<b>Introduction to Cytology /lecture</b>	<b>1</b>	<b>2</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Test
<b>1.2</b>	<b>Fundamentals of microscopic technology /practical classes</b>	<b>1</b>	<b>4</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3	2	Oral quiz Case-study
<b>1.3</b>	<b>General outline of the structure of eukaryotic cells /practical classes</b>	<b>1</b>	<b>4</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz Test
<b>1.4</b>	<b>Cell reproduction /practical classes</b>	<b>1</b>	<b>4</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz Essays
<b>1.5</b>	<b>Fundamentals of microscopy of histological preparations /self-study</b>	<b>1</b>	<b>16</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3	2	Practical skills
	<b>Section 2. General histology</b>						
<b>2.1</b>	<b>Epithelial Tissue /lecture</b>	<b>1</b>	<b>2</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Test

2.2	<b>Integumentary epithelium /practical classes</b>	1	6	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3	2	Oral quiz Case-study
2.3	<b>Glandular epithelium /practical classes</b>	1	4	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3	2	Oral quiz Essays Test
2.4	<b>Blood, lymph /lecture</b>	1	2	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Test
2.5	<b>Blood, lymph /practical classes</b>	1	4	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3	2	Oral quiz Essays
2.6	<b>Diagnostics of histological preparations /self-study</b>	1	16	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Practical skills
2.7	<b>Connective Tissue /lecture</b>	1	2	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Test
2.8	<b>Connective Tissue proper /practical classes</b>	1	4	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz Essays
2.9	<b>Skeletal connective tissue /practical classes</b>	1	4	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz
2.10	<b>Muscular Tissue /lecture</b>	1	2	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3	2	Test
2.11	<b>Muscular Tissue /practical classes</b>	1	4	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz Essays
2.12	<b>Nervous Tissue /lecture</b>	1	2	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Test

2.13	Nervous Tissue /practical classes	1	4	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz Essays
2.14	Diagnostics of histological preparations /self-study	1	16	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Practical skills
2.15	Credit for general histology/practical classes	1	4	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Practical skills
	<b>Section 3. Private histology</b>						
3.1	Nervous system /lecture	1	2	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Test
3.2	Peripheral nervous system /practical classes	1	4	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz
3.3	Central nervous system /practical classes	1	4	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz Essays
3.4	Organ of vision /lecture	1	1	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Test
3.5	Organ of vision /practical classes	1	6	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz Essays
3.6	The organ of hearing and vestibular /lecture	1	1	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Test
3.7	The organ of hearing and vestibular /practical classes	1	4	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz
3.8	Diagnostics of histological preparations /self-study	1	16	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Practical skills

<b>3.9</b>	<b>Cardiovascular system /lecture</b>	<b>2</b>	<b>1</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Test
<b>3.10</b>	<b>Cardiovascular system /practical classes</b>	<b>2</b>	<b>2</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz Essays
<b>3.11</b>	<b>Hematopoiesis. Central organs of hematopoiesis /lecture</b>	<b>2</b>	<b>1</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Test
<b>3.12</b>	<b>Central organs of hematopoiesis /practical classes</b>	<b>2</b>	<b>2</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz Essays
<b>3.13</b>	<b>Peripheral organs of hematopoiesis /lecture</b>	<b>2</b>	<b>1</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Test
<b>3.14</b>	<b>Peripheral organs of hematopoiesis /practical classes</b>	<b>2</b>	<b>2</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz
<b>3.15</b>	<b>Diagnostics of histological preparations /self-study</b>	<b>2</b>	<b>2</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Practical skills
<b>3.16</b>	<b>Respiratory system. Integumentary system /lecture</b>	<b>2</b>	<b>1</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Test
<b>3.17</b>	<b>Respiratory system. Integumentary system /practical classes</b>	<b>2</b>	<b>2</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz Essays
<b>3.18</b>	<b>Organs of the oral cavity /lecture</b>	<b>2</b>	<b>1</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Test



<b>3.19</b>	<b>Organs of the oral cavity /practical classes</b>	<b>2</b>	<b>2</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz Case-study
<b>3.20</b>	<b>Salivary glands /practical classes</b>	<b>2</b>	<b>2</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz
<b>3.21</b>	<b>Teeth /practical classes</b>	<b>2</b>	<b>2</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz
<b>3.22</b>	<b>Diagnostics of histological preparations /self-study</b>	<b>2</b>	<b>1</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Practical skills
<b>3.23</b>	<b>Esophagus, stomach /lecture</b>	<b>2</b>	<b>1</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Test
<b>3.24</b>	<b>Esophagus, stomach /practical classes</b>	<b>2</b>	<b>2</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz
<b>3.25</b>	<b>Intestine /lecture</b>	<b>2</b>	<b>1</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Test
<b>3.26</b>	<b>Intestine /practical classes</b>	<b>2</b>	<b>2</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz Case-study
<b>3.27</b>	<b>Liver, pancreas /lecture</b>	<b>2</b>	<b>1</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Test
<b>3.28</b>	<b>Liver, pancreas /practical classes</b>	<b>2</b>	<b>2</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz Essays
<b>3.29</b>	<b>Diagnostics of histological preparations /self-study</b>	<b>2</b>	<b>1</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Practical skills

<b>3.30</b>	<b>Credit for the digestive system /practical classes</b>	<b>2</b>	<b>4</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Practical skills
<b>3.31</b>	<b>Excretory system /lecture</b>	<b>2</b>	<b>1</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Test
<b>3.32</b>	<b>Excretory system /practical classes</b>	<b>2</b>	<b>2</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz Essays
<b>3.33</b>	<b>Male sexual system /lecture</b>	<b>2</b>	<b>1</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Test
<b>3.34</b>	<b>Male sexual system /practical classes</b>	<b>2</b>	<b>2</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz Essays
<b>3.35</b>	<b>Female sexual system I /lecture</b>	<b>2</b>	<b>1</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Test
<b>3.36</b>	<b>Female sexual system I /practical classes</b>	<b>2</b>	<b>2</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz Essays
<b>3.37</b>	<b>Female sexual system II /lecture</b>	<b>2</b>	<b>1</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Test
<b>3.38</b>	<b>Female sexual system II /practical classes</b>	<b>2</b>	<b>2</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz Essays
<b>3.39</b>	<b>Diagnostics of histological preparations /self-study</b>	<b>2</b>	<b>1</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Practical skills
<b>3.40</b>	<b>The endocrine system /lecture</b>	<b>2</b>	<b>2</b>	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Test

3.41	Central organs of the endocrine system /practical classes	2	2	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz
3.42	Peripheral organs of the endocrine system /practical classes	2	2	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Oral quiz
3.43	Diagnostics of histological preparations /self-study	2	1	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Practical skills
3.44	Credit for private histology /practical classes	2	4	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3		Practical skills
	<b>Section 4. Human Embryology</b>						
4.1	Early stages of human development /lecture	2	1	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3, L4		Test
4.2	Early stages of human development /practical classes	2	4	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3, L4		Oral quiz Essays
4.3	Human provisory organs /lecture	2	1	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3, L4		Test
4.4	Human provisory organs /practical classes	2	4	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3, L4		Oral quiz Essays

4.5	Diagnostics of histological preparations /self-study	2	2	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3	Practical skills
4.6	19 Exam	2	36	GPC -5.1 GPC – 5.2 GPC – 5.6	L1, L2, L3, L4	Oral quiz, Practical skills

## 5. ASSESSMENT TOOLS

### 5.1. Tests and tasks

Supplement 1

### 5.2. Topics for written papers

Supplement 1

### 5.3. ASSESSMENT TOOLS

Supplement 1

### 5.4. List of assessment tools

Oral quiz, Case-study, Practical skills, Essays, Tests

## 6. COURSE (MODULE) RESOURCES

### 6.1. Recommended Literature

#### 6.1.1. Core

	Authors	Title	Publish., year	Quantity
L1	S. L. Kuznetsov, T. V. Boronikhina, V. L. Goryachkina	Histology, Cytology and Embryology [Text]: (a Course of Lectures)	Moscow: Medical Informational Agency, 2004. 239 p.	31
L2	Vishram Singh	Inderbir Singh's Textbook of Human Histology [Text]: With Color Atlas and Practical Guide	New Delhi [etc.]: Jaypee. The Health Sciences Publisher, 2016. 302 p.: ill.	33
L3	J.P. Gunasegaran	Textbook of Histology [Text]: Atlas and Practical Guide	New Delhi: Elsevier, 2017. XVI, 438 p.: ill.	3

#### 6.1.2. Supplementary

	Authors	Title	Publish., year	Quantity
L4	Vishram Singh	Textbook of Clinical Embryology [Text]	Amsterdam: Elsevier, cop. 2017. 365 p.: ill.	3

#### 6.2. Internet resources

E1	Electronic library of medical University <a href="http://www.studmedlib.ru">www.studmedlib.ru</a>
E2	Electronic library system <a href="http://www.znanium.com">www.znanium.com</a>
E3	FreeMedicalJournals
E4	<a href="http://e.lanbook.com/">http://e.lanbook.com/</a>

#### 6.3.1 Software

6.3.1.1	Operational system Microsoft, applied programs pack Microsoft Office
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6.3.1.2	Internet access ( Wi-Fi)
<b>6.3.2 Information Referral systems</b>	
6.3.2.1	E-data bases: Orbicon, Medline.
6.3.2.2	Student Consultant <a href="http://www.studmedlib.ru">http://www.studmedlib.ru</a>
<b>7. MATERIAL AND TECHNICAL SUPPORT OF DISCIPLINE (MODULE)</b>	
<p>7.1. The lecture hall is equipped with a multimedia projector, a screen, a laptop, a stationary educational Board for chalk, typical educational furniture: desks, chairs.</p> <p>7.2. The training room for practical classes, group and individual consultations, ongoing monitoring and interim certification is equipped with a portable projector Epson (1 PCs), laptop (1 PCs), microscope Zeiss (12 PCs), video films, charts, models, microscope slide, study tables (10 PCs.), chairs (24 PCs.) interactive pathology class "VIRCHOW", Full HD Samsung IPS display (6 PCs.), interactive Smart Board SB480iv4, Lenovo laptop, Primo Star microscopes (8 PCs.).</p> <p>7.3. Morphological laboratory of the Department of pathophysiology and General pathology is equipped with: a microscope, a video camera with software, a computer, a microscope with a camera and a morphometric program, working microscopes, equipment for histological wiring of the material (microtome, water bath, thermostats, apparatus for histological wiring of the material), accessories for staining and immunohistochemical examination of the material, tools and consumables in an amount that allows students to master the skills provided by the program.</p>	
<b>8. Course manuals</b>	
Supplement 2	

**ASSESSMENT TOOLS**

Syllabus Supplement

**HISTOLOGY, EMBRYOLOGY, CYTOLOGY**

Qualification	Specialist
<b>Specialty</b>	31.05.01 General Medicine
Form of education	Full-time
Designer Department	Pathophysiology and General Pathology
Graduate Department	Internal diseases

## Sample tasks and tests

### Stage I: Formative assessment.

#### Topic 1. Cytology

##### Topic 1.1. Introduction to cytology /Lecture/

Task 1. Test control questions with answer standards

1) According to the location of the membrane proteins are divided into:

1. transport, catalytic, structural, receptor;
2. integral, semi-integral, surface;
3. movable, semi-movable, fixed;
4. crystalline, quasi-crystalline;
5. simple, complex

2) The chemical composition of biological membranes is as follows:

1. 30% lipids, 60% proteins, 10% carbohydrates;
2. 40% lipids, 50% proteins, 10% other substances;
3. 50% protein, 50% lipids;
4. 50% lipids, 30% proteins, 20% carbohydrates;
5. 55% lipids, 30% proteins, 15% carbohydrates

3) Intercellular adhesion is:

1. the process of interaction of specific glycoproteins of contiguous cell membranes;
2. the process of interaction of specific lipoproteins of touching cell membranes;
3. the process of interaction of specific proteins of cell membranes;
4. distant cell interactions with mediators;
5. interaction of the ligand with the cell surface receptor

##### Topic 1.2. Fundamentals of microscopic technology /Practical classes/

Task 1. Questions for the oral survey:

1. Definition of the subject of Histology. Sections of histology. The relationship of histology with other morphological and clinical sciences.

2. Problems of modern histology.

3. Methods of investigation in histology:

a) microscopy as the main method of investigation;

b) the method of fractional centrifugation, ultraviolet, fluorescence, phase - contrast, electron microscopy.

c) histochemical methods of research.

4. Methods of tissue culture, tissue and organ transplantation.

5. Types of histological preparations. The procedure for preparing a permanent histological preparation.

6. Histological sections. Their coloring. Histological dyes. Specific (elective) and histochemical methods of coloring.

Task 2. Examples of tasks with response standards

No. 1. Outside the plasmalemma, there are ions whose concentration is lower than in the cell. Is it possible for them to enter the cell?

Answer: Yes (active transport with energy consumption).

No. 2. During experimental work with cells in the stump of tissues, it was found that the cells do not change when exposed to the studied hormone. How can this be explained?

Answer: The lack of hormone receptors on these cells.

No. 3. Human cells have a soft, gelatinous consistency, but the whole body has a significantly higher density and strength. How to explain it?

Answer: The presence of a large amount of dense intercellular matter, especially in connective tissues.

### **Topic 1.3. General plan of the structure of eukaryotic cells /Practical classes/**

Task 1. Questions for the oral survey:

1. The cell as a structural and functional unit of tissue. Definition. Methods of research in cytology.

2. The general plan of the structure of eukaryotic cells.

3. Biological cell membranes, their structure, chemical composition and basic functions.

4. Plasmolemma, chemical composition and functions.



5. Intercellular connections. Types and structural and functional characteristics. Cytoplasm. General morpho-functional characteristics. Classification of organelles, their structure and function.

6. Physico-chemical properties of hyaloplasm and its significance in the vital activity of the cell.

7. Structural and functional characteristics of organelles involved in the biosynthesis of substances in the cell.

8. Structural and functional characteristics of organelles involved in intracellular digestion, protective and neutralizing reactions.

9. Structural and functional characteristics of organelles involved in energy production.

10. Structural and functional characteristics of organelles involved in the process. elimination of substances from the cell.

11. Special organelles in the cell. Their importance for the vital activity of a certain type of tissue.

12. Inclusions, their classification, chemical and morpho-functional characteristics.

13. The nucleus, its significance in the vital activity of the cell, the main components and their structural and functional characteristics. Nuclear-cytoplasmic relations as an indicator of the functional state of the cell.

14. Electron microscopic structure of the nucleus. Features of the structure of the karyolemma, the pore complex. The chemical composition of the core. Structure and function of the nucleolus. DNA. Types of RNA.

Task 2. Test control questions with answer standards

1) Cell organelles are divided into:

1. protein, non-protein, mixed;
2. general, special; membrane, non-membrane;
3. general, special, mixed; membrane, non-membrane;
4. general, special; membrane, non-membrane, mixed;
5. temporary, permanent

2) Common organelles include:

1. nucleus, Golgi complex, endoplasmic reticulum, lysosomes;
2. Golgi complex, ribosomes, lysosomes, peroxisomes, mitochondria, cell center, cytoskeleton components;
3. cytolemma, glycocalyx, cytoskeleton components;
4. ribosomes, Golgi complex, hyaloplasm, cytoskeleton components
5. Golgi complex, endoplasmic network, ribosomes, lysosomes, peroxisomes, mitochondria, cell center, cytoskeleton components;

3) What functions does the granular endoplasmic network perform?

1. breakdown of proteins, fats, carbohydrates;
2. transport of synthesized substances in the cell;
3. biosynthesis of carbohydrates and lipids;
4. protein biosynthesis and transport;
5. DNA biosynthesis

#### **Topic 1.4. Cell reproduction /Practical classes/**

Task 1. Questions for the oral survey:

1. Methods of cell reproduction, their morphological characteristics. The importance of cytology for medicine.
2. The life cycle of the cell, its stages, morpho-functional characteristics, features in different types of cells.
3. The main provisions of cell theory and its significance for the development of biology and medicine.
4. The mitotic cycle. The significance of interphase in the process of mitotic division. Mitosis. Phases of mitosis. The biological essence of mitosis.
5. The concept of karyotype. Autosomes and sex chromosomes. The structure of chromosomes in different phases of mitosis. Types of chromosomes depending on the location of the centromeres.

Task 2. Topics of the essays for the practical lesson:

1. Biological significance of the nuclear apparatus and its characteristics
2. Regulation of cell division processes at the sub-and supracellular level.
3. Interaction between different processes during mitosis (meiosis).
4. Pathological mitosis and its role in the vital activity of the cell.
5. Types of cell reproduction depending on the degree of differentiation and functional activity of cells.

#### **Topic 1.5. Fundamentals of microscopy of histological preparations /Self-study/**

Task 1. Microscopy of histological preparations (with a description)

1. Mesothelium of the omentum (cell boundaries, cell nuclei, stomata).
2. Blood smear (red blood cells, neutrophils, eosinophils, monocytes, lymphocytes).

3. Loose unformed connective tissue (fibroblasts, fibrocytes, histiocytes, collagen fibers, elastic fibers).

4. Striated muscle tissue of the tongue (transverse; longitudinal sections of muscle fibers (simplasts); simplast: sarcolemma, transverse striation, nuclei; endomysium; peremysium: vessels, nerves; multilayered epithelium.

5. Myelin-free nerve fibers: the axial cylinder and the cytoplasm of lemmocytes; the nuclei of Schwann cells.

## **Topic 2. General histology**

### **Topic 2.1. Epithelial tissues /Lecture/**

Task 1. Test control questions with answer standards

1) Which epithelium according to the morphofunctional classification are included in the group of single-layer?

1. single-layer single-row; single-layer multi-row; single-layer transition;
2. single-layer single-row; single-layer multi-row;
3. single-layer single-row; single-layer multi-row; single-layer transition; non-cornering;
4. single-layer single-row; single-layer multi-row; single-layer transition; keratinizing;
5. single-layer single-row; single-layer transition

2) Which epithelium is called single-layer?

1. in which not all cells are connected to the basement membrane;
2. in which all the cells are connected to the basement membrane;
3. in which the cells are not connected to the basement membrane;
4. keratinizing;
5. transitional;

3) Which epithelium is called transitional?

1. turning from a single-layer to a multi-layer;
2. turning from flat to prismatic;
3. turning from non-keratinizing to keratinizing;
4. turning from non-ferruginous to ferruginous;
5. changing the arrangement of cell layers in a stretched and non-stretched wall

## Topic 2.2. Integumentary epithelium /Practical classes/

Task 1. Questions for the oral survey:

1. Definition of the concept of "fabric". Principles of tissue classification. Physiological and reparative tissue regeneration.
2. Patterns of origin and evolution of tissues. Theories of parallelism by A. A. Zavarzin and divergent evolution by N. G. Khlopin.
3. Epithelial tissues. General characteristics. Principles of structural organization and function.
4. Morphofunctional classification of epithelial tissues.
5. Histogenetic classification of epithelial tissues.
6. Features of the structure and function of single-layer (single-row and multi-row) epithelium.
7. Morphofunctional characteristics of multilayer epithelium (non-keratinizing, keratinizing, transitional).
8. Physiological and reparative regeneration of epithelium. The role of stem cells. Composition and rate of differon renewal in various epithelial tissues.

Task 2. Examples of tasks with response standards

1) Atherosclerotic plaques were found on the inner surface of the vessels. What type of epithelium is affected? What is the structure of the epithelium lining the vessels, what functions does it perform?

Answer: Endothelium. Single-layer squamous epithelium, functions: protective, barrier, receptor.

2) A few months after the oral surgery, the patient complains of unpleasant sensations in the abdominal cavity and digestive disorders. The doctor suggests the development of the adhesive process in the area of surgical intervention. Violation of the regeneration of which epithelium causes the fusion of the peritoneal leaves? What is the structure of the peritoneal epithelium? In the composition of the membranes of which organs is this epithelial tissue found?

Answer: Mesothelium. Single-layer squamous epithelium. Lungs, heart, stomach, intestines.

3) The patient complains of a debilitating cough, which occurs mainly in the morning and is accompanied by the separation of viscous sputum. In the anamnesis – 15 years of smoking experience. Changes in the structural and functional properties of what type of epithelial tissue can be assumed in this situation? How does the structure and function of ciliated and goblet-shaped cells change when exposed to damaging environmental factors?

Answer: Ciliated epithelium (single-layer cylindrical multi-row epithelium). The cilia become immobile and break down, the goblet cells become larger, they produce more mucus.

### **Topic 2.3. Glandular epithelium /Practical classes/**

Task 1. Questions for the oral survey:

1. Glandular epithelium. Morphofunctional features of secretory epithelial cells.
2. Secretory cycle, types of secretion.
3. Classification of glands.
4. Structural and functional characteristics of the end sections and excretory ducts of the glands.

Task 2. Test control questions with answer standards

1) Which exocrine glands are called simple?

1. single-celled, without an excretory duct;
2. multicellular, with an unbranched excretory duct
3. with unbranched terminal sections, but with a branched excretory duct;
4. multicellular, with an unbranched excretory duct, but with a branched terminal section;
5. unbranched excretory duct

2) Which exocrine glands are called complex?

1. multicellular, with branched end sections;
2. with alveolar-tubular end sections and unbranched excretory duct;
3. with tubular end sections and unbranched excretory duct;
4. multicellular, with a branched excretory duct;
5. multicellular.

3) The sebaceous gland has several secretory sections in the form of sacs that open into the common excretory duct. Select the appropriate signs:

1. Exocrine;
2. endocrine system;
3. simple;
4. complex;

5. branched;
6. unbranched;
7. alveolar.

Task 3. Topics of the essays for the practical lesson:

1. The founder of evolutionary histology A. A. Zavarzin
2. Differentiation of cells in the process of histogenesis.
3. Physiological and reparative regeneration.
4. Modern ideas about the methods of formation and release of secretions from the cell.
5. Participation of cell structures in the process of secretion.

#### **Topic 2.4. Blood, lymph /Lecture/**

Task 1. Test control questions with answer standards

1) How did I. I. Mechnikov call neutrophilic leukocytes?

1. macrophages;
2. histiocytes;
3. microphages;
4. siderophages;
5. plasmocytes

2) What is the main function of neutrophils?

1. Antibody formation;
2. phagocytosis of microorganisms and small particles;
3. phagocytosis of the antigen-antibody complex;
4. histamine inactivation;
5. participation in allergic and anaphylactic reactions

3) T-lymphocytes undergo antigen-independent differentiation in:

1. lymph nodes;
2. thymus;

3. spleen;
4. appendix;
5. tonsils

### **Topic 2.5. Blood, lymph /Practical classes/**

Task 1. Questions for the oral survey:

1. General characteristics, histogenesis and principles of classification of tissues of the internal environment of the body.
2. Tissue characteristics of blood (plasma, shaped elements). The concept of a hemogram.
3. The main functions of the blood.
4. Classification of shaped blood elements and their morphofunctional characteristics.
5. Red blood cells: structure and functions.
6. Leukocytes: morphofunctional characteristics of granulocytes (neutrophilic, eosinophilic, basophilic) and agranulocytes (monocytes, lymphocytes).
7. The leukocyte formula and its clinical significance.
8. Morphofunctional characteristics of platelets.
9. Age - related and adaptive changes in blood.

Task 2. Topics of the essays for the practical lesson:

1. Age-related blood changes.
2. Accumulation of methemoglobin and age of red blood cells.
3. The role of T – and B-lymphocytes and granulocytes in the immunological reactions of the body.
4. Types of red blood cell hemoglobins. Characteristics of poikilocytosis, anisocytosis of erythrocytes.
5. Scheme of ultramicroscopic structure of lymphocytes.
6. The role of white blood cells in inflammation.
7. Lymph. Chemical composition, formation, and functions.

### **Topic 2.6. Diagnostics of histological preparations /Self-study/**

Task 1. Microscopy of histological preparations (with description)

1. Mesothelium of the omentum (cell boundaries, cell nuclei, stomata).

2. The small intestine. Single-layer edged epithelium.
3. Trachea. Multi-row ciliated epithelium.
4. The cornea. Multilayered flat non-keratinizing epithelium.
5. Finger skin. Epidermis: basal membrane, germinal layer (basal layer and layers of spiny cells), granular layer, shiny layer, stratum corneum.
6. Blood smear (red blood cells, neutrophils, eosinophils, monocytes, lymphocytes).

### **Topic 2.7. Connective tissues /Lecture/**

Task 1. Test control questions with answer standards

1) Loose, unformed connective tissue. Select structural and functional features:

1. a small amount of intercellular substance;
2. the mineral components of the main substance are 40-70%;
3. the fibers in the intercellular substance are arranged in a disordered manner;
4. protective, trophic, supporting, plastic functions;
5. variety of cellular elements;
6. mesenchymal origin

2) Fibroblastic differon. Select cells:

1. stem mesenchymal cells;
2. young fibroblasts;
3. macrophages;
4. differentiated fibroblasts;
5. fibrocytes;
6. osteoclasts

3) Determine the type of bone tissue cell according to the description. The cell lies on the surface of the developing bone beam, has a prismatic shape, and the cytoplasm has a well-developed protein synthesis apparatus.

1. fibroblast;
2. chondroblast;
3. osteoblast;
4. osteocyte;
5. osteoclast;



6. chondrocyte

### **Topic 2.8. Proper connective tissues /Practical classes/**

Task 1. Questions for the oral survey:

1. General characteristics, histogenesis and principles of classification of connective tissues, interrelation of structural and functional features.
2. Fibrous connective tissues. General structural and functional characteristics. Classification.
3. Loose fibrous connective tissue. Characteristics of cellular elements (fibroblastic cells, macrophages, mast cells, fat cells, pericytes, adventitial cells, white blood cells, pigment cells).
4. The composition of the intercellular substance, its functional properties, sources of formation. Characteristics of fibrous structures and the base substance.
5. Participation of connective tissue structures in the body's defense reactions (phagocytosis, inflammatory reaction).
6. Dense fibrous connective tissue, its varieties, structure and functions. The structure of the tendon.
7. Features of physiological and reparative regeneration of various types of fibrous tissue.
8. Histophysiology of connective tissues with special properties. Reticular tissue, structure and functions. Adipose tissue, its varieties and significance.
9. Embryonic connective tissues (mesenchyme, mucosa). Features of the structure, sources of development and ways of differentiation.

Task 2. Topics of the essays for the practical lesson:

1. Organ-specific features of connective tissue.
2. The main characteristics of connective tissue cells in the focus of aseptic inflammation.
3. The role of connective tissue in wound healing, the stages of the process and the relationship with pathogenetically based wound therapy.
4. Possibilities of physiological and reparative regeneration of the tendon.

### **Topic 2.9. Skeletal connective tissues /Practical classes/**

Task 1. Questions for the oral survey:

1. Sources of embryonic development, general morphofunctional characteristics and classification of skeletal tissues.

2. Cartilage tissue. General characteristics of cells and intercellular matter. Types of cartilage tissue (hyaline, elastic, fibrous).

3. Hyaline cartilage tissue. Structural-functional and topographic characteristics. The structure of hyaline cartilage. Regeneration and age-related changes.

4. Elastic cartilage tissue. Features of the structure of elastic cartilage.

5. Fibrous cartilage tissue. Localization, structure, and functions.

6. Bone tissue. General characteristics, classification.

7. Direct and indirect histogenesis.

8. Cellular composition of bone tissue (osteoblasts, osteocytes, osteoclasts).

9. Physical and chemical properties and structure of the intercellular substance.

10. The structure of the diaphysis of the tubular bone.

11. Regeneration of lamellar bone tissue. Factors that affect bone remodeling.

12. Coarse-fibrous bone tissue. General characteristics, localization, and structural features of the intercellular substance.

## **Topic 2.10. Muscle tissue /Lecture/**

Task 1. Test control questions with answer standards

1) What structures of skeletal muscle fiber serve as a depot of calcium ions? You take the correct answer.

1. T-tube;

2. caveola;

3. sarcoplasmic reticulum;

4. muscle spindle

2) Cardiac and skeletal muscle tissue. Select common structural features:

1. transverse striation of myofibrils;

2. sarcomeres;

3. insert discs between the fibers;

4. myosatellite cells;

5. when shrinking, the light disks disappear;

6. the fibers are covered with a basal membrane

3) Atypical cardiomyocytes. Select structural and functional characteristics:

1. make up the conducting system of the heart;
2. oval-shaped cells, larger than typical cardiomyocytes;
3. the core is located eccentrically;
4. the entire volume of the cytoplasm is occupied by myofibrils;
5. capable of generating and conducting pulses

### **Topic 2.11. Muscle tissues /Practical classes/**

Task 1. Questions for the oral survey:

1. General morphofunctional characteristics and classifications of muscle tissues.
2. Skeletal striated muscle tissue: histogenesis, morphological and functional characteristics.
3. The structure of the contractile apparatus and the mechanism of contraction of muscle fibers.
4. Types of muscle fibers.
5. Regeneration of skeletal muscle tissue, the role of myosatellitocytes.
6. Cardiac striated muscle tissue: source of development, morphofunctional characteristics, regeneration possibilities.
7. Smooth muscle tissue: sources of development, histophysiology, and regeneration.

Task 2. Topics of the essays for the practical lesson:

1. Modern concepts of ultrastructure and histophysiology of striated muscle fiber.
2. Electron microscopic structure of smooth muscle cells.
3. Modern ideas about the regeneration of the heart muscle.
4. Dynamics of changes in muscle tissue from the birth of a child to 16 years of life.
5. T-systems of the endoplasmic network of skeletal muscle myosimplasts.

### **Topic 2.12. Nervous tissue /Lecture/**

Task 1. Test control questions with answer standards

1) Which nerve tissue cells are formed from the neural tube? Choose the right answers:

neurons

1. astrocytes
2. ependymoglyocytes
3. oligodendrogliaocytes
4. microgliaocytes

2) Classification of neurons by the number of processes. Select the types of neurons:

1. unipolar
2. bipolar
3. pseudomultipolar
4. pseudonipolar
5. multipolar

3) The connection in the pair is not correct:

1. ependymoglyocyte-macrogliia
2. microglyocyte-macrophage of nervous tissue
3. oligodendrogliaocyte-shells around the bodies and processes of neurons
4. astrocyte-microglia

### **Topic 2.13. Nervous tissue /Practical classes/**

Task 1. Questions for the oral survey:

1. General characteristics of the nervous tissue. Sources and mechanisms of embryonic histogenesis.
2. Neurons. Morphological and functional classifications. Micro-and ultrastructure of the pericardium and processes (axon, dendrites). The role of the plasmolemma in the reception, generation and conduction of nerve impulses. Physiological death and regeneration of neurons.
3. Neuroglia. General characteristics, classification. The structure of macroglia (oligodendroglia, astro-glia, and ependymoglia) and microglia. The role of glia in the functioning of nervous tissue.
4. Nerve fibers. Classification. Formation, structure and functions of myelin and myelin-free nerve fibers. Degeneration and regeneration of nerve fibers.
5. Nerve endings. General characteristics and classification. Structure and functions of the receptor and effector nerve endings.

6. Interneuronal connections. Classification of synapses. Ultrastructure of chemical synapses and mechanisms of nerve impulse transmission. Synaptic plasticity.

7. Reflex arcs. General characteristics of the sensitive, associative, and motor parts of the reflex arcs.

Task 2. Topics of the essays for the practical lesson:

1. The reaction of neurons and nerve fibers to trauma.

2. Efferent innervation of striated muscles.

3. Afferent innervation of skeletal muscles, tendons, and joints.

4. Regenerative capabilities of elements of nervous tissue (neurons, neuroglia, nerve fibers) and age-related changes.

5. Cytological and molecular bases of reception.

#### **Topic 2.14. Diagnostics of histological preparations /Self-study/**

Task 1. Microscopy of histological preparations (with a description)

1. Loose unformed connective tissue (fibroblasts, fibrocytes, histiocytes, collagen fibers, elastic fibers).

2. The tendon in the cross section (bundles of the first order – one collagen fiber; tendon cells; endotenonium; peritenonium).

3. Fibrous cartilage (bundles of collagen fibers, small between them; isogenic groups; hyaline cartilage - on the periphery).

4. Elastic cartilage (perichondrium; a layer of chondroblasts; isogenic groups of chondrocytes; the intercellular substance: elastic fibers, amorphous substance).

5. Lamellar bone on the example of the cross-section of the tubular bones (periosteum; the outer layer of the General records; concentric plate (osteons); inserted records; osteocytes; folkman vessel; a vessel of osteon).

6. Hyaline cartilage of the trachea: epiglottis, isogenic groups, chondromucoid.

7. Bone development from mesenchyma-direct osteogenesis. Identify bone plates: osteoblasts, osteocytes, osteoclasts, osteoid, osteomucoid. Mesenchyma: process cells, vessels.

8. Striated muscle tissue of the tongue (transverse; longitudinal sections of muscle fibers (simplasts); simplast: sarcolemma, transverse striation, nuclei; endomysium; peremysium: vessels, nerves; multilayered epithelium.

9. Myelin-free nerve fibers: the axial cylinder and the cytoplasm of lemmocytes; the nuclei of Schwann cells.

10. Myelin nerve fibers: Ranvier intercepts; axial cylinder; myelin sheath.

#### **Topic 2.15. Credit for general histology /Practical classes/**

### Task 1. Microscopy of histological preparations (with a description)

1. Mesothelium of the omentum (cell boundaries, cell nuclei, stomata).
2. The small intestine. Single-layer edged epithelium.
3. Trachea. Multi-row ciliated epithelium.
4. The cornea. Multilayered flat non-keratinizing epithelium.
5. Finger skin. Epidermis: basal membrane, germinal layer (basal layer and layers of spiny cells), granular layer, shiny layer, stratum corneum.
6. Blood smear (red blood cells, neutrophils, eosinophils, monocytes, lymphocytes).
7. Loose unformed connective tissue (fibroblasts, fibrocytes, histiocytes, collagen fibers, elastic fibers).
8. Tendon in cross-section (bundles of the first order – one collagen fiber; tendon cells; endotenonium; peritenonium).
9. Fibrous cartilage (bundles of collagen fibers, small between them; isogenic groups; hyaline cartilage - on the periphery).
10. Elastic cartilage (epiglottis; chondroblast layer; isogenic groups of chondrocytes; intercellular substance: elastic fibers, amorphous substance).
11. Lamellar bone tissue on the example of a cross-section of a tubular bone (periosteum; outer layer of general plates; concentric plates (osteons); inset plates; osteocytes; Volkman's vessel; osteon vessel).
12. Hyaline cartilage of the trachea: epiglottis, isogenic groups, chondromucoid.
13. Bone development from mesenchyma-direct osteogenesis. Identify bone plates: osteoblasts, osteocytes, osteoclasts, osteoid, osteomucoid. Mesenchyma: process cells, vessels.
14. Striated muscle tissue of the tongue (transverse; longitudinal sections of muscle fibers (symplasts); symplast: sarcolemma, transverse striation, nuclei; endomysium; peremysium: vessels, nerves; multilayered epithelium).
15. Myelin-free nerve fibers: the axial cylinder and the cytoplasm of lemmocytes; the nuclei of Schwann cells.
16. Myelin nerve fibers: Ranvier intercepts; axial cylinder; myelin sheath.

### **Topic 3. Discrete Histology**

#### **Topic 3.1. The nervous system /Lecture/**

##### Task 1. Test control questions with answer standards

- 1) The cytoarchitectonics of the cerebral cortex is:
  1. regular arrangement of Betz cells;
  2. the natural location of the nerve fibers of the cortex;

3. regular arrangement of cortical neurons;
4. the natural location of the neuroglia;
5. regular arrangement of stellate cells

2) The column (module) of the cerebral cortex is:

1. structural element of the cortex;
2. functional element of the cortex
3. structural and functional element of the cortex;
4. microcirculatory element of the cortex;
5. part of the hemato-encephalic barrier

3) The hemato-encephalic barrier is:

1. perivascular space;
2. a set of components of the capillary wall, glial elements and their derivatives that provide selective penetration of various substances to neurons;
3. neurohemal organ;
4. terminal expansion of neuronal axons;
5. the set of components of the capillary wall

### **Topic 3.2. Peripheral nervous system /Practical classes/**

Task 1. Questions for the oral survey:

1. Organs of the nervous system. General morphofunctional characteristics. Sources and mechanisms of embryonic development. Classification.
2. Spinal nerve nodes. Localization, structure, connection with other organs of the nervous system.
3. Autonomic nerve nodes. Structure, localization, and functions. Classification of neurons of the autonomic ganglia.
4. The structure of the peripheral nerves. Mechanisms of regeneration after damage.
5. The spinal cord. Sources of embryonic development, morphofunctional characteristics of gray and white matter. Regeneration.
6. Somatic reflex arc. The structure of afferent, associative, and efferent links.

### **Topic 3.3. Central nervous system /Practical classes/**

Task 1. Questions for the oral survey:

1. The cerebellum. General morphofunctional characteristics and sources of embryonic development. The structure of gray and white matter.
2. Neural composition, layer-by-layer organization, and the main reflex arcs of the cerebellar cortex. Afferent and efferent pathways of the cerebellum. Glia of the cerebellum.
3. The cerebral cortex. Sources of embryonic development, structure and functions. The concept of cyto- and myeloarchitectonics of the cortex. Granular and agranular types of cortex.
4. Structural and functional characteristics of the cortical module. Afferent and efferent pathways, intramodular organization.
5. The autonomic nervous system. General structural characteristics and main functions.
6. Characteristics of afferent, associative and efferent links of sympathetic and parasympathetic reflex arcs. Differences between vegetative reflex arcs and somatic arcs.
7. Histophysiology of sympathetic and intramural ganglia. Intra-organ reflex arcs.
8. The membranes of the brain and spinal cord: structure and functions.
9. Blood supply to the central nervous system. The blood-brain barrier.

Task 2. Topics of the essays for the practical lesson:

1. Morphofunctional characteristics of the sympathetic and parasympathetic parts of the ANS.
2. Morphofunctional characteristics of the brain membranes.
3. On the theoretical aspects of brain ontogenesis.
4. Modular principle of histophysiology of the cerebral cortex.
5. Development of the mammalian and human cerebral cortex.
6. The structure and role of the reticular formation of the brain stem.

### **Topic 3.4. Organ of vision /Lecture/**

Task 1. Test control questions with answer standards

1) Choose the correct answers. The eye develops from the following rudiments:

1. endoderms;
2. ectoderms;



3. mesoderms;
4. mesenchymes;
5. neural tube

2) The eye consists of the following shells:

1. fibrous, vascular and iridescent;
2. fibrous, vascular, mucosal;
3. fibrous, vascular, reticular;
4. adventitial, vascular, and reticular;
5. fibrous, muscular, vascular and reticular

3) Choose the correct answers. The outer nuclear layer of the retina is formed by:

1. the bodies of rod neurons
2. bodies of bipolar cells
3. the bodies of cone neurons
4. amacrine cell bodies
5. bodies of horizontal cells

### **Topic 3.5. Organ of vision /Practical classes/**

Task 1. Questions for the oral survey:

1. The concept of sensor systems (analyzers) and their main departments. Sensory organs, their classification. 2. Histophysiology of neurosensory and epitheliosensory cells.
3. The organ of vision. Sources of development, structural and functional characteristics of the membranes of the eyeball.
4. Histophysiology of the light-refractive (dioptric) apparatus. The structure of the cornea, lens, and vitreous body.
5. Accommodation apparatus of the eye: histophysiology of the iris, ciliary body, ciliary girdle.
6. The receptor apparatus of the eye. Retinal structure, histophysiology of photoreception. Features of the structure of the retina in the area of the blind and yellow spots.
7. Auxiliary eye apparatus. Eye muscles. Eyelids. The lacrimal apparatus.

8. Olfactory sensory systems. Sources of development and histophysiology of the main olfactory system.

9. Vomeronasal organ: features of structure and function.

Task 2. Topics of the essays for the practical lesson:

1. Development of the visual organ. Research by A. I. Babukhin and I. F. Ognev.

2. Morphofunctional justifications of visual analyzer hygiene.

3. Evolution of the structural, cytological, and functional organization of the sensory organs.

### **Topic 3.6. The organ of hearing and vestibular /Lecture/**

Task 1. Test control questions with answer standards

1) Choose the correct answers. The outer ear consists of parts:

1. the tympanic cavity;
2. the auricle;
3. external auditory canal;
4. the auditory tube

2) Choose the correct answers. The middle ear consists of:

1. The cochlea;
2. the tympanic cavity;
3. semicircular channels;
4. auditory ossicles;
5. the auditory tube

3) Choose the correct answer: Stereocilia of the outer cortical hair cells

1. the organs are in contact with the surface:
2. basilar plate;
3. otolith membrane;
4. tectorial membrane;
5. vascular strips

### **Topic 3.7. The organ of hearing and vestibular /Practical classes/**

Task 1. Questions for the oral survey:

1. The organ of hearing and balance. General morphofunctional characteristics.
2. The outer ear. Histophysiology of the auricle, external auditory canal, and tympanic membrane.
3. Middle ear. Structure and functions of the tympanic cavity, auditory bones, and auditory tube. Connection of the tympanic cavity with the nasopharynx. Tubal amygdala.
4. The inner ear. The structure of the membranous labyrinth of the snail. Histophysiology of the spiral (cortical) organ.
5. Webbed labyrinth of semicircular canals. Histophysiology of spots of sacs and ampullary scallops.
6. The organ of taste: localization, development, structure, functions.

### **Topic 3.8. Diagnostics of histological preparations /Self-study/**

Task 1. Microscopy of histological preparations (with a description)

1. Neurovascular bundle (mixed nerve: nerve fibers, epineurium; muscle-type artery; medium-caliber vein).
2. Spinal ganglion (posterior spinal cord root; connective capsule; sensitive nerve cells; satellite cell nuclei; nerve fibers: axial cylinders, Schwann cell nuclei; anterior spinal cord root).
3. Spinal cord (central canal; white matter, nerve fibers; gray matter: anterior, posterior horns of gray matter, multipolar neurons).
4. The cerebellum (gray matter: molecular layer; ganglion layer: Purkinje cells; granular layer: nuclei of associative cells; white matter - in the center of the gyrus).
5. The cortex of the cerebral hemispheres (white matter: nerve fibers; gray matter: molecular layer, a layer of giant pyramidal Betz cells, a polymorphic layer. White matter: nerve fibers. Microvessels).
6. Longitudinal incision of the inner ear (cochlea: cochlea axis: spiral scallop, spiral ganglion; membranous labyrinth: vestibular membrane, spiral ligament, vascular strip, tympanic membrane, cortical organ, integumentary plate; bony labyrinth, tympanic staircase, vestibular staircase).
7. The cornea of the eye (multilayer flat non-corneal epithelium, Bowman's membrane, corneal stroma, descemet's membrane, descemet's single-layer flat epithelium-endothelium).
8. The back wall of the eye (sclera, choroid, retina: pigment layer, the layer of rods and cones, the outer border membrane, outer granular layer, outer mesh layer, internal granular layer, inner mesh layer, the ganglion cells, the nerve fiber layer, the inner limiting membrane).

### **Topic 3.9. Cardiovascular system /Lecture/**

Task 1. Test control questions with answer standards

- 1) What is the name of the process of vascular development?

1. hematopoiesis;
2. histogenesis;
3. angiogenesis;
4. endotheliogenesis;
5. vasculogenesis

2) What are the sources of heart development?

1. mesenchyme;
2. endoderm and mesenchyme;
3. parts of the visceral leaf of the splanchnotome and ectoderm;
4. parts of the visceral leaf of the splanchnotome and mesenchyma;
5. parts of the parietal leaf of the splanchnotome and mesenchyma.

3) The heart wall consists of the following membranes:

1. mucosa, submucosa, muscle, adventitial;
2. mucosal, muscular, serous;
3. endocardium, myocardium, epicardium, adventitial;
4. endocardium, myocardium, epicardium

### **Topic 3.10. Cardiovascular system /Practical classes/**

Task 1. Questions for the oral survey:

1. Blood vessels: histogenesis, general plan of the wall structure, functions, classification.
2. Vessels of the microcirculatory bed. General characteristics.
3. Classification and structural features of hemocapillaries.
4. Structure and functions of arterioles and venules.
5. Features of the structure of lymphatic vessels.
6. Structure and significance of arteriolo-venular anastomoses. Structural mechanisms of small vessel permeability.
7. Principles of classification of arteries and veins. Dependence of the structure of the vascular wall on hemodynamic conditions.

8. Elastic, mixed and muscular type arteries: localization, wall structure, age-related changes.

9. Veins of the muscular and non-muscular type: localization, structure and functions.

10. The heart: sources of embryonic development, micro -, ultrastructure, and histophysiology of the endocardium, myocardium, and epicardium. Regeneration of heart structures.

Task 2. Topics of the essays for the practical lesson:

1. Microstructure of the valvular apparatus of the heart.

2. The conducting system of the heart.

3. Anastomoses and their role in the microcirculation system.

4. Electron microscopy data on differences in the structure of the walls of blood and lymphatic capillaries.

### **Topic 3.10. Diagnostics of histological preparations /Self-study/**

Task 1. Microscopy of histological preparations (with a description)

1. Neurovascular bundle (mixed nerve: nerve fibers, epineurium; muscle-type artery; medium-caliber vein).

2. Spinal ganglion (posterior spinal cord root; connective capsule; sensitive nerve cells; satellite cell nuclei; nerve fibers: axial cylinders, Schwann cell nuclei; anterior spinal cord root).

3. Spinal cord (central canal; white matter, nerve fibers; gray matter: anterior, posterior horns of gray matter, multipolar neurons).

4. The cerebellum (gray matter: molecular layer; ganglion layer: Purkinje cells; granular layer: nuclei of associative cells; white matter - in the center of the gyrus).

5. The cortex of the cerebral hemispheres (white matter: nerve fibers; gray matter: molecular layer, a layer of giant pyramidal Betz cells, a polymorphic layer. White matter: nerve fibers. Microvessels.

6. Longitudinal incision of the inner ear (cochlea: cochlea axis: spiral scallop, spiral ganglion; membranous labyrinth: vestibular membrane, spiral ligament, vascular strip, tympanic membrane, cortical organ, integumentary plate; bony labyrinth, tympanic staircase, vestibular staircase).

7. The cornea of the eye (multilayer flat non-corneal epithelium, Bowman's membrane, corneal stroma, descemet's membrane, descemet's single-layer flat epithelium-endothelium).

8. The back wall of the eye (sclera, choroid, retina: pigment layer, the layer of rods and cones, the outer border membrane, outer granular layer, outer mesh layer, internal granular layer, inner mesh layer, the ganglion cells, the nerve fiber layer, the inner limiting membrane).

9. Arterioles, venules, capillaries meninges (arteriole: the nuclei of the endothelial nuclei of smooth muscle cells of venules, capillaries).

10. Elastic type artery – aorta (middle shell: elastic membranes; outer shell).

11. The heart wall (endocardium, myocardium, Purkinje fibers).

### **Topic 3.11. Hematopoiesis. Central organs of hematopoiesis /Lecture/**

Task 1. Test control questions with answer standards

1) Choose the correct answer. The bodies of the Hassal goiter gland are formed:

1. macrophages;
2. T-lymphocytes;
3. T-lymphoblasts;
4. concentrically layered epithelial reticulocytes;
5. B-lymphocytes

2) Choose the correct answers. The hematothymus barrier consists of:

1. The endothelium with the basement membrane
2. mesothelium with basal membrane
3. pericapillary space
4. epithelial reticulocytes with a basal membrane
5. loose fibrous connective tissue

3) Choose the correct answer. In the thymus is carried out:

1. antigen-independent proliferation and differentiation of B-lymphocytes;
2. antigen-independent proliferation and differentiation of T-lymphocytes;
3. antigen-dependent proliferation and differentiation of B-lymphocytes;
4. antigen-dependent proliferation and differentiation of T-lymphocytes

### **Topic 3.12. Central organs of hematopoiesis /Practical classes/**

Task 1. Questions for the oral survey:

1. General characteristics of the system of hematopoietic organs and immune defense. Classification.
2. Embryonic hematopoiesis. Mesoblastic, hepatic, and medullary stages of hematopoiesis. The role of the microenvironment in hematopoiesis.

3. Postembryonic hematopoiesis. Theory of hematopoiesis. Modern scheme of hematopoiesis: general characteristics, the concept of a colony-forming unit (CFU), morphofunctional characteristics of classes I-VI of hematopoietic cells.

4. Erythrocytopoiesis and thrombocytopoiesis in the embryonic and postembryonic periods.

5. Leukocytopoiesis in the embryonic and postembryonic periods.

6. Regulation of hematopoiesis. The concept of homoblastic and heteroblastic types of hematopoiesis.

7. Red bone marrow. Characteristics of hematopoietic islets and microenvironment (stromal components, macrophages), structural features of blood vessels. Regeneration. Yellow bone marrow.

8. Thymus. Development, structure and functions of the cortical and medullary matter. The concept of the hematothymus barrier. Histophysiology of the subcapsular zone. Age-related and accidental thymus involution.

Task 2. Topics of the essays for the practical lesson:

1. The unitary theory of hematopoiesis according to Maximov, and its regulation. Restoration of blood as tissue.

2. Cytofunctional characteristics of the stem cell.

3. Reactivity of thymus gland tissues in the issues of accidental and age-related organ involution.

### **Topic 3.13. Peripheral organs of hematopoiesis /Lecture/**

Task 1. Test control questions with answer standards

1) Choose the correct answer. The thymus-dependent zone of the white pulp of the spleen is:

1. periarterial zone;

2. germinative center;

3. mantle zone;

4. marginal zone

2) Choose the correct answer. The interdigitating cells of the lymph node are located in the:

1. the cortical zone of the cortical substance;

2. paracortical area;

3. brain matter

3) Choose the correct answers. Antigen-dependent differentiation and proliferation of T -

lymphocytes occur in:

1. red bone marrow;
2. thymus;
3. spleen;
4. lymph nodes

### **Topic 3.14. Peripheral organs of hematopoiesis /Practical classes/**

Task 1. Questions for the oral survey:

1. General characteristics of the peripheral organs of hematopoiesis. The concept of antigen-dependent hematopoiesis.
2. Lymph nodes. Localization, sources of embryonic development. General characteristics.
3. Histophysiology of the cortical substance of the lymph node. Stromal and macrophage elements of lymph nodes in different zones. Structural changes of lymph nodes under antigenic influence.
4. Paracortical zone of the lymph node: features of the structure and lymphocytopoiesis.
5. Histophysiology of the medulla of the lymph node. Plasmocytopoiesis.
6. The system of lymph flow in the lymph node. Localization and structure of the sinuses of the lymph node. Involvement of the lymph nodes in the immune response.
7. Spleen. Sources of embryonic development, general morphofunctional characteristics, spleen functions in the embryonic and postnatal periods.
8. White pulp of the spleen: histophysiology of lymph nodes (stroma, macrophages, T - and B-zones). Periarterial lymphoid vaginas.
9. Structure and functions of the red pulp of the spleen. Open and closed circulatory systems in the spleen.
10. The role of the spleen in the formation of the immune response.
11. Unified immune system of the mucous membranes: general morphofunctional characteristics. Histophysiology of the palatine tonsil.
12. Structural foundations of immune responses. Definition of concepts: immunity, antigen, antibody. General morphofunctional characteristics of immunocompetent cells (T-lymphocytes, B-lymphocytes, plasma cells, natural killer cells, antigen-presenting cells). Interaction of cells in the immune response.
13. Cellular and humoral immune responses.

### **Topic 3.15. Diagnostics of histological preparations /Self-study/**



### Task 1. Microscopy of histological preparations (with a description)

1. Arterioles, venules, capillaries meninges (arteriole: the nuclei of the endothelial nuclei of smooth muscle cells of venules, capillaries).
2. Elastic type artery – aorta (middle shell: elastic membranes; outer shell).
3. The heart wall (endocardium, myocardium, Purkinje fibers).
4. Lymph node (capsule, trabeculae, cortical substance: secondary nodules, reactive center; medulla: cerebral cords; sinuses: marginal, intermediate cortical, intermediate cerebral).
5. Spleen (capsule, mesothelium, trabeculae: trabecular artery, vein, bundles of smooth muscle cells; white pulp – splenic (Malpighian) corpuscles, central artery; red pulp).
6. Smear of red bone marrow (myeloid tissue, developing blood cells: blast, metamyelocyte, myelocyte, red blood cell series, progenitor cells).
7. Histosection of the red bone marrow in the bone cavities of the flat bone (according to the pituitary preparation) (sinusoid capillaries, nuclei of reticular and hematopoietic cells, megakaryocytes, fat cells).

### **Topic 3.16. Respiratory system. Integumentary system /Lecture/**

#### Task 1. Test control questions with answer standards

1) What is the system of the skin?

1. skin (epidermis, dermis, subcutaneous fat;
2. skin, hair, glands, nails;
3. skin, hair, glands;
4. skin, glands, nails
5. skin and subcutaneous muscle

2) What layer is missing in the epidermis of thin skin?

1. horny;
2. basal;
3. spiky;
4. shiny;
5. Grainy

3) What structure does the respiratory department of the lungs begin with?

1. terminal bronchiola;

2. respiratory bronchiola;
3. respiratory bronchiola;
4. alveolar bronchiola;
5. small-caliber bronchial tubes

### **Topic 3.17. The respiratory system. Leather /Practical classes/**

Task 1. Questions for the oral survey:

1. Skin. Sources of development and general morphofunctional characteristics.
2. The epidermis. Structure, characteristics of the keratinization process. The role of Langerhans cells, melanocytes, and Merkel cells in the functioning of the epidermis. Influence of external and internal environmental factors on the keratinization process. Features of the structure of the epidermis in different parts of the body.
3. The dermis. Histophysiology of the papillary and reticular layers of the dermis. The immunobiological role of the skin. The involvement of dermal cells in the inflammatory response.
4. Morphofunctional characteristics of hypoderma.
5. Skin derivatives. Skin glands, their classification, sources of development, structure, functions.
6. Histophysiology of the merocrine and apocrine sweat glands.
7. Sebaceous glands, their structure and mechanism of secretion formation.
8. Hair. Sources of development, structure. Development, growth and change of hair.
9. Structure of nails.
10. Respiratory system. General morphofunctional characteristics, sources of embryonic development.
11. Airways. General plan of the wall structure, functions.
12. Histophysiology of the nasal mucosa, nasopharynx, larynx. The connection of the nasopharynx with the middle ear. Immunobiological role of lymphoid tissue, histophysiology of tonsils.
13. The structure of the trachea and bronchi of different calibers.
14. Respiratory department. General morphofunctional characteristics. Structure of the pulmonary acinus.
15. The structure of the alveolar wall. Surfactant alveolar complex (sources of formation, structure, functional significance, timing of formation in embryogenesis).
16. The structure of interalveolar partitions. Aerogematic barrier.
17. Morphofunctional changes in the respiratory system when exposed to environmental factors (exhaust gases, tobacco smoke, harmful industrial factors).

Task 2. Topics of the essays for the practical lesson:

1. Histophysiology of the epidermis in different age periods.
2. The structure and function of the sebaceous glands in different age periods.
3. Hair growth and change.
4. Regenerative capabilities of skin tissues. Structural justification of skin functions.
5. Dermatoglyphics and its significance in the diagnosis of diseases.

**Topic 3.18. Oral organs /Lecture/**

Task 1. Test control questions with answer standards

1) There are the following types of papillae of the tongue:

1. filamentous, diamond-shaped, flat;
2. filamentous, rough, mushroom-shaped, flat;
3. diamond-shaped, flat, grooved, filamentous;
4. filamentous, mushroom-shaped, leaf-shaped, flat;
5. filamentous, mushroom-shaped, leaf-shaped, grooved.

2) What elements of the tooth develop from the dental sac?

1. dentinoblasts and periodontitis;
2. ameloblasts and periodontitis;
3. cementoblasts and periodontium;
4. dentinoblasts and tooth pulp;
5. enamel organ pulp

3) What morphological type of organs are the large salivary glands?

1. parenchymal lobules;
2. parenchymal bundle cells;
3. parenchymal zonal;
4. parenchymal atypical;
5. parenchymal mixed

### **Topic 3.19. Organs of the oral cavity /Practical classes/**

Task 1. Questions for the oral survey:

1. Sources of embryonic development and the general plan of the structure of the digestive tube wall.
2. General characteristics of the structure of the wall of the anterior, middle and posterior sections of the digestive tube.
3. Tissue organization of the mucosa, submucosa, muscle and outer membranes.
4. Features of the structure of the mucous membrane of the oral cavity, the relationship with the functions performed.
5. Lip. The structure of the skin, mucous and transitional parts of the lip.
6. Gum, cheek, palate. Similarity and features of the structure, functions.
7. Histophysiology of the language. Papillae of the tongue: classification, localization, structure, functions. Features of the structure of the dorsal and lower surfaces of the tongue.

Task 2. Examples of tasks with response standards

1) When examining the patient, there is a white plaque on the tongue. What can be associated with the formation of plaque? What epithelium covers the upper and lower surfaces of the tongue?

Answer: Increased keratinization. Multilayered flat non - keratinized, on the back-tongue partially keratinized.

2) Prepared micro-preparations of the lips of a newborn child and the lips of an adult. By what structural features can they be differentiated? What determines the structural features of the transitional part of the lip?

Answer: According to the thickness of the epithelial cover (the adult has a thicker layer), the presence of epithelial papillae in the transitional part of the lip in the newborn child. Preparation of the child (in-utero) for breastfeeding.

### **Topic 3.20. Salivary glands /Practical classes/**

Task 1. Questions for the oral survey:

1. Salivary glands. General characteristics, origin, classification.
2. Large salivary glands. General principle of structure and function. The difference in the structure of the secretory departments and excretory ducts.
3. Parotid salivary gland. Characteristics of the end sections and excretory ducts. Age-related changes.
4. Submandibular and sublingual salivary glands. Features of the structure and function.

### **Topic 3.21. Teeth /Practical classes/**

Task 1. Questions for the oral survey:

1. Embryonic sources of tooth tissue development.
2. The main periods of tooth development: laying of dental rudiments, formation and differentiation of dental rudiments, histogenesis of tooth tissues.
3. The period of laying the dental rudiments. Dental plaque. Dental kidney.
4. Formation and differentiation of dental rudiments.
5. Histogenesis of tooth tissues.
6. Features of the bookmark of milk and permanent teeth. Histophysiological mechanisms of tooth change. Teething.
7. General characteristics of the tooth structure. Calcified and non-calcified tooth tissues.
8. The structure of enamel. Processes of remineralization, possibilities of regeneration.
9. Dentin. Features of the structure of dentin in different parts of the tooth. Regeneration.
10. Cement. Structure and functions of cellular and cell-free cement. Regeneration.
11. Histophysiology of the pulp. Features of the course of the inflammatory reaction.
12. The supporting apparatus of the tooth: structure, functions, regeneration.

### **Topic 3.22. Diagnostics of histological preparations /Self-study/**

Task 1. Microscopy of histological preparations (with a description)

1. Lip (skin, transitional, mucous part of the lip, muscle, connective tissue, blood vessels, glands).
2. Leaf-shaped papillae of the tongue (secondary connective tissue papillae, taste buds, salivary glands of Ebner, striated muscle of the tongue).
3. Filamentous papillae of the tongue (cone of keratinization). Mushroom-shaped papillae. Muscle fibers.
4. Tooth development. Multilayered gum epithelium; dental plate. The rudiment of a tooth is an enamel organ. Early stage.
5. Tooth development. The rudimentary tooth. Late stage (tooth pulp, odontoblasts, dentin, enamel, ameloblasts-adamantoblasts).
6. Palatine tonsil: crypt, multilayered epithelium, lymphoid follicles in the mucosal lamina proper, connective tissue capsule, submucosa, mixed salivary glands.

7. Protein parotid salivary gland. Lobule: protein secretory sections, salivary tubes. Interlobular connective tissue layers, interlobular excretory ducts, vessels.

### **Topic 3.23. Esophagus, stomach /Lecture/**

Task 1. Test control questions with answer standards

1) What cells, other than epithelial cells, are part of the esophageal epithelium?

1. melanocytes, Merkel cells;
2. plasmocytes, melanocytes;
3. melanocytes, Merkel and Langerhans cells;
4. intraepithelial lymphocytes and plasmocytes;
5. intraepithelial lymphocytes, Langerhans cells, endocrinocytes

2) What functions does the stomach not perform?

1. secretory and digestive;
2. depositing and motor-tow trucks;
3. barrier-protective, suction and excretory;
4. synthesis of calcitriol and calcitonin;
5. Castle factor synthesis and endocrine function

3) Which epithelium is part of the gastric mucosa?

1. single-layer single-row flat;
2. single-layer single-row cubic;
3. single-layer single-row prismatic ferruginous;
4. single-layer single-row prismatic edged;
5. single-layer multi-row ciliated

### **Topic 3.24. Esophagus, stomach /Practical classes/**

Task 1. Questions for the oral survey:

1. General plan of the structure of the esophageal wall.

2. Histophysiology of the esophageal mucosa. Mechanisms of plasticity under external influence.
3. Structure and tissue composition of the esophageal wall in various departments.
4. Esophageal glands, their origin, structure and functions.
5. The transition of the esophagus to the stomach: features of the structure of the shells.
6. General characteristics of the stomach: structure of the wall, functions, sources of embryonic development.
7. Relief of the gastric mucosa in various parts.
8. Cytophysiological characteristics of the gastric epithelium. Regeneration.
9. Gastric glands: localization, classification, cellular composition, functions, sources of regeneration.
10. Histophysiology of the muscular and external membranes of the stomach.

### **Topic 3.25. Intestine /Lecture/**

Task 1. Test control questions with answer standards

1) What are intestinal crypts?

1. protrusion of the epithelium into the lumen of the intestine;
2. deepening of the epithelium into the own plate of the mucous membrane;
3. deepening of the epithelium into the submucosa;
4. deepening of the epithelium and its own plate into the submucosa;
5. protrusion of the mucous membrane into the lumen of the intestine in the form of a finger

2) Which epithelium is part of the mucosa of the small intestine?

1. single-layer single-row flat;
2. single-layer single-row cubic;
3. single-layer single-row prismatic ferruginous;
4. single-layer single-row prismatic edged;
5. single-layer multi-row ciliated

3) Cavernous cells (M-cells. the epithelium of the small intestine is:

1. macrophages;
2. granular lymphocytes;

3. antigen-presenting epithelial cells of Peyer's plaques;
4. natural killers in peyer's own plate of plaques
5. natural killers in the epithelium of Peyer's plaques

### **Topic 3.26. Intestines /Practical classes/**

Task 1. Questions for the oral survey:

1. The general principle of the structure and sources of development of the wall of the small and large intestine.
2. The relief of the mucous membrane in various parts of the intestine.
3. Small intestine: the structure of the wall and its tissue composition in various parts (duodenum, jejunum, ileum).
4. Cellular composition of the crypt and villi epithelium, their functions.
5. The crypta-villus system. Histophysiology of parietal digestion and absorption. Endocrine function of the intestine.
6. Large intestine: structure of the wall, features of the relief and cellular composition of crypts, functions.
7. Rectum: features of the structure of the wall and blood supply.
8. The immunobiological role of the structures of the small and large intestine. Worm-like process, features of structure and function.

Task 2. Examples of tasks with response standards

1) On micro-preparations of the stomach, only the mucous membrane is determined. By what signs can you determine the department of the stomach? What are the structural features of the fundal and pyloric glands?

Answer: By the depth of the stomach pits, the branching of their own glands. The fundal glands of the stomach are weakly branched, the pyloric glands are branched with a small number of main and lining cells.

2) Removal of the appendix leads to a violation of immunobiological protection and digestion. Why? What other structures in the digestive system are related to the immune system?

Answer: The vermiform process regulates digestion due to the cells of the APUD system, contains a large number of lymphoid nodules. Tonsils of the oral cavity, M-cells.

### **Topic 3.27. Liver, pancreas /Lecture/**

Task 1. Test control questions with answer standards



1) What type of capillaries are there in the liver?

1. continuous;
2. fenestrated;
3. sinusoid;
4. lacunar;
5. mixed

2) What blood vessels supply the liver?

1. portal vein and ventral trunk;
2. the celiac trunk and the hepatic artery;
3. iliac artery and portal vein;
4. hepatic artery and portal vein;
5. hepatic artery and inferior vena cava

3) What morphological type of organs does the pancreas belong to?

1. atypical;
2. parenchymal zonal;
3. parenchymal bundle;
4. parenchymal lobular;
5. parenchymal mixed

### **Topic 3.28. Liver, pancreas /Practical classes/**

Task 1. Questions for the oral survey:

1. The pancreas. Sources of development, functions, and structure of the exocrine and endocrine parts.
2. Histophysiology of the exocrine part. The structure of the acinus, the secretory cycle of acinocytes.
3. Endocrine islets. Morphofunctional characteristics of endocrinocytes. Cells-and organs-are targets of pancreatic hormones.
4. Liver. General characteristics of the structure and functions.
5. Blood supply to the liver. Features of the structure of sinusoid capillaries. Perisinusoidal space and its structural organization (macrophages, lipocytes, Pit cells).

6. The concept of the structural and functional unit of the liver. The structure of the classical lobule. Cytophysiology of hepatocytes.

7. Histophysiology of the hepatic barrier.

8. The system of bile formation and bile excretion. Structure of bile capillaries, cholangioles, bile ducts.

9. Gallbladder. Structure and functions.

Task 2. Topics of the essays for the practical lesson:

1. Pancreatic endocrinocytes. Their micro-and ultrastructure, functions, and place in the system of hormone-producing cells of the gastrointestinal tract.

2. Histophysiology of the bile ducts and gallbladder.

3. Structural and functional characteristics of hepatocytes in ontogenesis, their regenerative capabilities in the age aspect.

4. Ultrastructure of the elements of the wall of the sinusoid capillaries of the liver. Features of the structure of the walls of the liver vessels.

### **Topic 3.29. Diagnostics of histological preparations /Self-study/**

Task 1. Microscopy of histological preparations (with a description)

1. Cross-section of the esophagus. Shells. Mucosa: multilayered epithelium, connective tissue plate. Submucosal base, own glands of the esophagus. Muscle sheath: striated muscle fibers (circular layer; longitudinal layer). Adventitia.

2. The bottom of the stomach (mucosa: gastric fossa, fundal glands, lining cells, muscle plate of the mucosa; submucosa, muscle membrane-three layers; serous membrane).

3. Pyloric section of the stomach (mucous membrane: gastric fossa, pyloric glands, muscle plate of the mucosa; submucosa; muscle membrane: pronounced circular layer, longitudinal layer; serous membrane).

4. Duodenum (mucosa: villi, crypts, muscle plate of the mucosa; submucosa: Brunner's glands; muscle membrane-two layers, serous membrane).

5. Jejunum (mucosa; high villi, and their cross sections, crypts, goblet cells, mucosal muscle plate; submucosa; muscle shell; serous shell).

6. Colon (mucosa; crypts, goblet cells, solitary follicle, mucosal muscle plate; submucosa, muscle shell; serous shell).

7. Pig liver (hepatic lobule: central vein; hepatocytes of the beams; interlobular connective tissue; triad; artery, vein, bile duct, collecting vein).

8. Human liver (complex lobules: central veins, insertion veins, hepatic beams, sinusoid capillaries, triad, collective vein).

9. Pancreas Exocrine part: lobules: secretory departments; interlobular connective tissue, interlobular excretory duct, vessels. The endocrine part in the lobules: islets of Langerhans.

### **Topic 3.30. Test for the digestive system /Practical classes/**

Task 1. Microscopy of histological preparations (with a description)

1. Lip (skin, transitional, mucous part of the lip, muscle, connective tissue, blood vessels, glands).
2. Leaf-shaped papillae of the tongue (secondary connective tissue papillae, taste buds, salivary glands of Ebner, striated muscle of the tongue).
3. Filamentous papillae of the tongue (cone of keratinization). Mushroom-shaped papillae. Muscle fibers.
4. Tooth development. Multilayered gum epithelium; dental plate. The rudiment of a tooth is an enamel organ. Early stage.
5. Tooth development. The rudimentary tooth. Late stage (tooth pulp, odontoblasts, dentin, enamel, ameloblasts-adamantoblasts).
6. Palatine tonsil: crypt, multilayered epithelium, lymphoid follicles in the mucosal lamina proper, connective tissue capsule, submucosa, mixed salivary glands.
7. Protein parotid salivary gland. Lobule: protein secretory sections, salivary tubes. Interlobular connective tissue layers, interlobular excretory ducts, vessels.
8. Cross-section of the esophagus. Shells. Mucosa: multilayered epithelium, connective tissue plate. Submucosal base, own glands of the esophagus. Muscle sheath: striated muscle fibers (circular layer; longitudinal layer). Adventitia.
9. The bottom of the stomach (mucosa: gastric fossa, fundal glands, lining cells, muscle plate of the mucosa; submucosa, muscle membrane-three layers; serous membrane).
10. Pyloric division of the stomach (mucous membrane: gastric fossa, pyloric glands, muscle plate of the mucosa; submucosa; muscle membrane: pronounced circular layer, longitudinal layer; serous membrane).
11. Duodenum (mucosa: villi, crypts, muscle plate of the mucosa; submucosa: Brunner's glands; muscle membrane-two layers, serous membrane).
12. Jejunum (mucosa; high villi, and their cross sections, crypts, goblet cells, mucosal muscle plate; submucosa; muscle membrane; serous membrane).
13. Large intestine (mucosa; crypts, goblet cells, solitary follicle, mucosal muscle plate; submucosa, muscle membrane; serous membrane).
14. Pig liver (hepatic lobule: central vein; hepatocytes of the beams; interlobular connective tissue; triad; artery, vein, bile duct, collecting vein).
15. Human liver (complex lobules: central veins, insertion veins, hepatic beams, sinusoid capillaries, triad, collective vein).

16. Pancreas Exocrine part: lobules: secretory parts; interlobular connective tissue, interlobular excretory duct, vessels. The endocrine part in the lobules: islets of Langerhans.

### **Topic 3.31. Excretory system /Lecture/**

Task 1. Test control questions with answer standards

1) The structural and functional unit of the kidney is:

1. slice;
2. acinus;
3. nephron;
4. pyramid;
5. The Ferrain beam

2) What substance is synthesized by juxtaglomerular cells?

1. bradykinin;
2. renin;
3. prostaglandins;
4. calcitriol;
5. urokinase

2) What is the basal striation of nephrocytes?

1. intussusception of the cytolemma;
2. complex of organelles of protein synthesis;
3. accumulation of mitochondria;
4. invaginations of the basal cytolemma and the accumulation of mitochondria between them;
5. invagination of the apical cytolemma and the accumulation of lysosomes between them

### **Topic 3.32. Excretory system /Practical classes/**

Task 1. Questions for the oral survey:

1. Sources and main stages of embryonic kidney development (kidney, primary kidney, final kidney).

2. Kidneys. Morphofunctional characteristics of the cortical and medullary matter.

3. The nephron as a structural and functional unit of the kidney. Features of the structure and function of cortical and parotid nephrons.

4. Blood supply to the kidneys. Features of blood supply to the cortical and parotid nephrons.

5. Phases of urination. Histophysiology of various sections of the nephron (proximal section, nephron loop, distal section) and collecting tubes.

6. Kidney filtration barrier.

7. The endocrine apparatus of the kidneys (juxtaglomerular apparatus and renin-angiotensin system, kallikrein-bradykinin system, prostaglandin apparatus). Hormonal regulation of urination.

8. Urinary tract. Development, structure, and functional significance of the renal pelvis, ureters, and bladder.

Task 2. Topics of the essays for the practical lesson:

1. Formation of the structural and functional unit of the kidney-nephron in ontogenesis.

2. Endocrine function of the kidneys. Histophysiology of the juxtaglomerular apparatus of the kidneys.

### **Topic 3.33. Male sexual system /Lecture/**

Task 1. Test control questions with answer standards

1) Which cells in the testicle are the main producers of testosterone?

1. Sertoli cells;

2. Leydig cells;

3. myoid cells;

4. spermatogonia;

5. spermatids

2) Which cells of the convoluted seminal tubule synthesize the liquid medium of the tubule?

1. Sertoli cells;

2. myoid cells;

3. spermatids;

4. spermatogonia;

5. spermatocytes of the 1st order

3) What structure prevents the development of autoimmune processes in the testicle?

1. the shell of the convoluted seminal tubule;
2. hemocapillary endothelium;
3. Interstitial loose fibrous unformed connective tissue;
4. myoid cells and their basal membrane;
5. hemato-testicular barrier

### **Topic 3.34. Male sexual system /Practical classes/**

Task 1. Questions for the oral survey:

1. General characteristics of the organs of the male reproductive system. Generative and endocrine functions.
2. Embryonic rudiments of the male reproductive system and their differentiation. Conditions that ensure the differentiation of the sexual system according to the male type.
3. Testicles. General morphofunctional characteristics.
4. Histophysiology of convoluted seminal tubules. Structure of the tubule wall. The hemotesticular barrier.
5. Structure and functions of supporting cells (sustentocytes) and epitheliospermatogenic layer.
6. Generative function of the testicles. Spermatogenesis. Characteristics of the phases of meiotic division of spermatocytes.
7. Endocrine function of the testicles. Hormonal regulation of the functioning of the male reproductive system.
8. Histophysiology of the vas deferens. Structure and functions of the direct tubules, tubules of the testicular network.
9. The appendage of the testicle. Features of the structure of the excretory convoluted tubules and the duct of the appendage.
10. Vas deferens, vas deferens: structure and functions.
11. The accessory glands of the male reproductive system. Histophysiology of seminal vesicles.
12. Prostate gland: structure, function, age-related changes.
13. Structure and functions of the bulbourethral glands.

Task 2. Topics of the essays for the practical lesson:

1. Sperm ultrastructure and spermatogenesis. Factors affecting spermatogenesis.

2. Organogenesis and features of the structure of the organs of the male reproductive system at various stages of ontogenesis.

### **Topic 3.35. Female sexual system I /Lecture/**

Task 1. Test control questions with answer standards

1) The primordial follicle is characterized by the following features:

1. contains ovogonia surrounded by a single layer of flat follicular cells;
2. contains an oocyte of the 2nd order, surrounded by a single layer of flat follicular cells;
3. contains an oocyte of the 1st order, surrounded by two layers of cubic follicular cells;
4. contains an oocyte of the 1st order, surrounded by multilayered follicular cells with spaces between them;
5. contains an oocyte of the 1st order, surrounded by a single layer of flat follicular cells

2) What morphological type of organs does the ovary belong to?

1. layered;
2. parenchymal zonal;
3. parenchymal bundle;
4. parenchymal lobular;
5. atypical

3) What is the brain matter of the ovary formed by?

1. loose fibrous unformed connective tissue with blood vessels;
2. growing and atretic follicles;
3. epithelial tissue;
4. yellow and white bodies;
5. loose fibrous unformed connective tissue and primordial follicles

### **Topic 3.36. Female sexual system I /Practical classes/**

Task 1. Questions for the oral survey:

1. General characteristics of the organs of the female reproductive system. Generative and endocrine functions.

2. Embryonic development of the female reproductive system.
3. The ovary. General morphofunctional characteristics. Sources and mechanisms of embryogenesis.
4. The structure of the cortical and medullary matter of the ovary. Histophysiology of primordial, primary, secondary, vesicular, and mature follicles.
5. Phases of the formation of the yellow body.
6. Atretic follicles, atretic bodies, white body: sources of formation, structure, functions.
7. Generative function of the ovaries. Ovogenesis. Comparative characteristics of spermatogenesis and ovogenesis.
8. Endocrine function of the ovaries. Sources of hormone formation. The effect of ovarian hormones on the genitals and pituitary gland.
9. The ovarian cycle (follicular phase, ovulation, luteal phase) and its hormonal regulation.
10. Development, structure and functions of the oviducts.

### **Topic 3.37. Female sexual system II /Lecture/**

Task 1. Test control questions with answer standards

1) What is the name of the inner lining of the uterus?

1. endothelium;
2. endomysium;
3. endometrium;
4. perimetrium;
5. parametry

2) What is the name of the middle layer of the myometrium and what is the direction of the bundles of myocytes in it?

1. submucosal, circular;
2. vascular, circular;
3. supravascular, oblique;
4. subcovascular, oblique;
5. submucosal, oblique

3) What is the name of the secretory department of the breast?

1. lobule;



2. acinus (alveolus);
3. island;
4. the follicle;
5. glomerulus

### **Topic 3.38. The female sexual system II /Practical classes/**

Task 1. Questions for the oral survey:

1. The uterus. General morphofunctional characteristics. Sources and mechanisms of embryonic development.
2. Endometrium. Structure, features of blood supply, cyclic changes and their hormonal regulation.
3. Myometrium. Histophysiology, features of regeneration. Perimetry and parametrization: structure and functional significance.
4. Histophysiology, cyclic changes of the cervix.
5. The vagina. Development, structure, cyclic changes of the mucous membrane.
6. Ovarian-menstrual cycle: concept, phases, duration. The role of the hypothalamic-adenohypophysial system in the regulation of the ovarian-menstrual cycle.
7. The mammary gland. Sources of embryonic development, structure, features of secretion. Communication with the reproductive system. Structural changes in various phases of the ovarian-menstrual cycle, during pregnancy and lactation.

### **Topic 3.39. Diagnostics of histological preparations /Self-study/**

Task 1. Microscopy of histological preparations (with a description)

1. Rat kidney. The capsule. Cortical substance: renal body: vascular glomerulus, mesangial cell nuclei, podocytes of the intravenous capsule leaf, capsule cavity, outer capsule leaf; proximal convoluted nephron, distal convoluted nephron). Medulla: straight tubules. The boundary between cortical and medullary matter: arc vessels, renal corpuscles of juxtamedullary nephrons.
2. Ureter (mucosa: transitional epithelium, connective tissue plate; submucosa; muscle membrane-two layers of myocytes; adventitial membrane).
3. The bladder (the mucous membrane has a folded character: the transitional epithelium, the connective tissue plate; the submucosa; bundles of myocytes of the three-layer muscular membrane, layers of connective tissue; the serous membrane, the nuclei of the mesothelium).
4. Testis (albumen, cross-sections of the convoluted tubule, Sertoli cell nuclei, identify germ cells at different stages of differentiation, interstitial connective tissue, Leydig cells, blood capillaries).

5. The appendage of the testis (sections of the canal of the appendage: double-row epithelium, accumulation of spermatozoa; vas deferens: scalloped epithelium).

6. The prostate gland. Capsule, interlobular layers of connective tissue, bundles of myocytes, interlobular ducts. Urethra: transitional epithelium. Lobule: terminal secretory sections, stellate, interstitial, bundles of myocytes.

7. Ovary (rudimentary epithelium-mesothelium of the protein shell; cortical substance: primordial, growing, dense, mature follicles: in the mature follicle, determine the follicle shells: granular shell, connective tissue theca, follicle cavity, egg-bearing tubercle, oocyte of the 1st order, radiant crown of the oocyte. The atretic body. Remains of the yellow body at the stage of reverse development. Brain matter: connective tissue, blood vessels.

8. Oviduct: mucosa: mucosal villi (epithelium, connective tissue); muscle membrane (two layers); serous membrane.

9. The yellow body (capsule, luteal cells, connective tissue layers).

10. Mammalian uterus: endometrium (epithelium, connective tissue, uterine glands); myometrium (three layers, determine the vascular layer of the myometrium); perimetrium (connective tissue, mesothelium).

### **Topic 3.40. Endocrine system /Lecture/**

Task 1. Test control questions with answer standards

1) The central organs of the endocrine system include:

1. parathyroid gland, adrenal gland, epiphysis;
2. hypothalamus, epiphysis, pituitary gland;
3. thyroid gland, thymus, islets of Langerhans of the pancreas;
4. the endocrine parts of the gonads, the medulla of the adrenal glands;
5. adrenal cortex, diffuse endocrine system

2) What is the structural and functional unit of the thyroid gland?

1. acinus;
2. island;
3. slice;
4. trabecula;
5. the follicle

3) Aldosterone is synthesized by endocrinocytes:

1. glomerular zone of the adrenal cortex

2. sudanophobic zone of the adrenal cortex
3. the bundle zone of the adrenal cortex
4. the reticular zone of the adrenal cortex
5. epinephrocytes of the adrenal medulla

### **Topic 3.41. Peripheral organs of the endocrine system /Practical classes/**

Task 1. Questions for the oral survey:

1. The endocrine system. General morphofunctional characteristics. The concept of hormones, target cells and their interaction. The relationship between the nervous and endocrine systems. Classification of organs and cells with endocrine functions.
2. Peripheral endocrine glands and their relationship with the central organs of the endocrine system.
3. Histophysiology of the thyroid gland. Sources of embryonic development. The follicle as a structural and functional unit and its morphofunctional characteristics. Regeneration.
4. Secretory cycle of thyrocytes. Features of the structure of the follicles in hypo- and hyperfunction of the thyroid gland.
5. Calcitoninocytes (parafollicular cells, C-cells), their localization, structure and functions.
6. Parathyroid gland. Sources of embryonic development and localization. Structure and functions, organs and target cells of parathyroid hormone.
7. The role of the thyroid and parathyroid glands in the regulation of calcium metabolism.
8. The adrenal glands. Sources of embryonic development of cortical and medullary matter.
9. Histophysiology of the cortical substance. The structure, mechanisms of action, and target organs of glomerular, bundle, and reticular hormones. The relationship of the secretory activity of the glomerular zone with the renin-angiotensin system.
10. Histophysiology of the adrenal medulla.
11. Participation of the adrenal glands in the body's protective reactions under stress. Nervous and humoral regulation of secretory activity of the adrenal glands.

### **Topic 3.42. Central organs of the endocrine system /Practical classes/**

Task 1. Questions for the oral survey:

1. The hypothalamus. Embryonic development and general morphofunctional characteristics. Histophysiology of the neurosecretory nuclei of the anterior and middle divisions.

2. Hypothalamic-pituitary relationship and relationship with peripheral endocrine organs.
3. Pituitary gland. Sources and mechanisms of embryonic development. Morphofunctional characteristics of the adenohypophysis (anterior, middle, and tuberal lobes).
4. Structural and functional characteristics of chromophobic and chromophilic endocrinocytes.
5. Portal blood flow system and its role in the hypothalamic regulation of adenohypophysial hormone formation.
6. Morphofunctional characteristics of the neurohypophysis and its connection with the neurosecretory nuclei of the hypothalamus.
7. The main organs and target cells of pituitary hormones. The principle of "direct" and "reverse" communication of the adenohypophysis and peripheral endocrine organs.
8. Structural and functional manifestations of hypo- and hyperfunction of the pituitary gland.
9. Epiphysis. Sources of embryonic development, structure, and functions. The role of the epiphysis in the regulation of cyclic processes in the body. Age-related changes in the epiphysis.
10. Single hormone-producing cells. APUD system.

### **Topic 3.43. Diagnostics of histological preparations /Self-study/**

Task 1. Microscopy of histological preparations (with a description)

1. Thyroid gland (lobule: follicles, epithelium of the wall, colloid, interstitium, interfollicular islets, interlobular connective tissue).
2. Pituitary gland (adenohypophysis-anterior lobe: epithelial cords, capillaries; middle lobe: pseudofollicles; epithelial cords; Rathke pocket residue; neurohypophysis-posterior lobe). Red bone marrow in the bone cavities of the flat bone (sinusoid capillaries, nuclei of reticular and hematopoietic cells, megakaryocytes, fat cells).
3. Adrenal gland: Connective tissue capsule, trabeculae. Cortical substance: glomerular zone, sudanophobic zone, bundle zone, reticular zone; medulla: blood vessels, chromaphin cells-endocrinocytes.

### **Topic 3.44. Credit for private histology /Practical classes/**

Task 1. Microscopy of histological preparations (with a description)

1. Neurovascular bundle (mixed nerve: nerve fibers, epineurium; muscle-type artery; medium-caliber vein).
2. Spinal ganglion (posterior spinal cord root; connective capsule; sensitive nerve cells; satellite cell nuclei; nerve fibers: axial cylinders, Schwann cell nuclei; anterior spinal cord root).
3. Spinal cord (central canal; white matter, nerve fibers; gray matter: anterior, posterior horns of gray matter, multipolar neurons).

4. The cerebellum (gray matter: molecular layer; ganglion layer: Purkinje cells; granular layer: nuclei of associative cells; white matter - in the center of the gyrus).
5. Cortex of the cerebral hemispheres (white matter: nerve fibers; gray matter: molecular layer, layer of giant pyramidal Betz cells, polymorphic layer. White matter: nerve fibers. Microvessels).
6. Longitudinal incision of the inner ear (cochlea: cochlea axis: spiral scallop, spiral ganglion; membranous labyrinth: vestibular membrane, spiral ligament, vascular strip, tympanic membrane, cortical organ, integumentary plate; bony labyrinth, tympanic staircase, vestibular staircase).
7. The cornea of the eye (multilayer flat non-corneal epithelium, Bowman's membrane, corneal stroma, descemet's membrane, descemet's single-layer flat epithelium-endothelium).
8. The back wall of the eye (sclera, choroid, retina: pigment layer, the layer of rods and cones, the outer border membrane, outer granular layer, outer mesh layer, internal granular layer, inner mesh layer, the ganglion cells, the nerve fiber layer, the inner limiting membrane).
9. Arterioles, venules, capillaries meninges (arteriole: the nuclei of the endothelial nuclei of smooth muscle cells of venules, capillaries).
10. Elastic type artery – aorta (middle shell: elastic membranes; outer shell).
11. The heart wall (endocardium, myocardium, Purkinje fibers).
12. Lymph node (capsule, trabeculae, cortical substance: secondary nodules, reactive center; medulla: cerebral cords; sinuses: marginal, intermediate cortical, intermediate cerebral).
13. Spleen (capsule, mesothelium, trabeculae: trabecular artery, vein, bundles of smooth muscle cells; white pulp – splenic (Malpighian) corpuscles, central artery; red pulp).
14. Smear of red bone marrow (myeloid tissue, developing blood cells: blast, metamyelocyte, myelocyte, erythrocyte cells, progenitor cells).
15. Histosection of the red bone marrow in the bone cavities of the flat bone (according to the pituitary preparation) (sinusoid capillaries, nuclei of reticular and hematopoietic cells, megakaryocytes, fat cells).
16. Lip (skin, transitional, mucous part of the lip, muscle, connective tissue, blood vessels, glands).
17. Leaf-shaped papillae of the tongue (secondary connective tissue papillae, taste buds, salivary glands of Ebner, striated muscle of the tongue).
18. Filamentous papillae of the tongue (cone of keratinization). Mushroom-shaped papillae. Muscle fibers.
19. Tooth development. Multilayered gum epithelium; dental plate. The rudiment of a tooth is an enamel organ. Early stage.
20. Tooth development. The rudimentary tooth. Late stage (tooth pulp, odontoblasts, dentin, enamel, ameloblasts-adamantoblasts).
21. Palatine tonsil: crypt, multilayered epithelium, lymphoid follicles in the own plate of the mucosa, connective tissue capsule, submucosa, mixed salivary glands.
22. Protein parotid salivary gland. Lobule: protein secretory sections, salivary tubes. Interlobular connective tissue layers, interlobular excretory ducts, vessels.

23. Cross-section of the esophagus. Shells. Mucosa: multilayered epithelium, connective tissue plate. Submucosal base, own glands of the esophagus. Muscle sheath: striated muscle fibers (circular layer; longitudinal layer). Adventitia.
24. The bottom of the stomach (mucosa: gastric fossa, fundal glands, lining cells, muscle plate of the mucosa; submucosa, muscle membrane-three layers; serous membrane).
25. Pyloric division of the stomach (mucosa: gastric fossa, pyloric glands, muscle plate of the mucosa; submucosa; muscle membrane: pronounced circular layer, longitudinal layer; serous membrane).
26. Duodenum (mucosa: villi, crypts, muscle plate of the mucosa; submucosa: Brunner's glands; muscle membrane-two layers, serous membrane).
27. Jejunum (mucosa; high villi, and their cross sections, crypts, goblet-shaped cells, muscle plate of the mucosa; submucosa; muscle membrane; serous membrane).
28. The large intestine (mucosa; crypts, goblet cells, solitary follicle, muscle plate of the mucosa; submucosa, muscle membrane; serous membrane).
29. Pig liver (hepatic lobule: central vein; hepatocytes of the beams; interlobular connective tissue; triad; artery, vein, bile duct, collecting vein).
30. Human liver (complex lobules: central veins, insertion veins, hepatic beams, sinusoid capillaries, triad, collective vein).
31. Pancreas Exocrine part: lobules: secretory parts; interlobular connective tissue, interlobular excretory duct, vessels. The endocrine part in the lobules: islets of Langerhans.
32. Rat kidney. The capsule. Cortical substance: renal body: vascular glomerulus, mesangial cell nuclei, podocytes of the intravenous capsule leaf, capsule cavity, outer capsule leaf; proximal convoluted nephron, distal convoluted nephron). Medulla: straight tubules. The boundary between cortical and medullary matter: arc vessels, renal corpuscles of juxtamedular nephrons.
33. Ureter (mucosa: transitional epithelium, connective tissue plate; submucosa; muscle membrane-two layers of myocytes; adventitial membrane).
34. The bladder (the mucous membrane has a folded character: the transitional epithelium, the connective tissue plate; the submucosa; bundles of myocytes of the three-layer muscular membrane, layers of connective tissue; the serous membrane, the nuclei of the mesothelium).
35. Testis (albumen, cross sections of the convoluted tubule, Sertoli cell nuclei, to identify germ cells at different stages of differentiation, interstitial connective tissue, Leydig cells, blood capillaries).
36. The appendage of the testis (sections of the canal of the appendage: double-row epithelium, accumulation of spermatozoa; vas deferens: scalloped epithelium).
37. The prostate gland. Capsule, interlobular layers of connective tissue, bundles of myocytes, interlobular ducts. Urethra: transitional epithelium. Lobule: terminal secretory sections, stellate, interstitial, bundles of myocytes.
38. Ovary (rudimentary epithelium-mesothelium of the protein shell; cortical substance: primordial, growing, dense, mature follicles: in the mature follicle, determine the follicle shells: granular shell, connective tissue theca, follicle cavity, egg-bearing tubercle, oocyte of the 1st order, radiant crown of the oocyte. The atretic body. Remains of the yellow body at the stage of reverse development. Brain matter: connective tissue, blood vessels).

39. Oviduct: mucosa: mucosal villi (epithelium, connective tissue); muscle membrane (two layers); serous membrane.

40. Yellow body (capsule, luteal cells, connective tissue layers).

41. Mammalian uterus: endometrium (epithelium, connective tissue, uterine glands); myometrium (three layers, determine the vascular layer of the myometrium); perimetrium (connective tissue, mesothelium).

42. Thyroid gland (lobule: follicles, epithelium of the wall, colloid, interstitium, interfollicular islets, interlobular connective tissue).

43. Pituitary gland (adenohypophysis-anterior lobe: epithelial cords, capillaries; middle lobe: pseudofollicles; epithelial cords; Rathke pocket residue; neurohypophysis-posterior lobe). Red bone marrow in the bone cavities of the flat bone (sinusoid capillaries, nuclei of reticular and hematopoietic cells, megakaryocytes, fat cells).

44. Adrenal gland: Connective tissue capsule, trabeculae. Cortical substance: glomerular zone, sudanophobic zone, bundle zone, reticular zone; medulla: blood vessels, chromaphin cells-endocrinocytes.

#### **Topic 4. Human embryology**

##### **Topic 4.1. Early stages of human development /Lecture/**

Task 1. Test control questions with answer standards

1) Name the initial stage of embryogenesis:

1. crushing;
2. gastrulation;
3. fertilization;
4. organogenesis;
5. notogenesis

2) Name the period of embryogenesis, in which the transition from a single-celled stage of development to a multicellular one occurs:

1. fertilization;
2. gastrulation;
3. histogenesis;
4. crushing;
5. notogenesis

3) What is the type of crushing characteristic of the human zygote?

1. complete uniform synchronous;
2. full non-uniform asynchronous;
3. incomplete non-uniform asynchronous;
4. incomplete uniform asynchronous;
5. incomplete uniform synchronous

#### **Topic 4.2. Early stages of human development /Practical classes/**

Task 1. Questions for the oral survey:

1. Human embryogenesis. Periods of intrauterine development and their morphofunctional characteristics.

Fertilization: concept, general characteristics, stages.

2. Zygote and its preparation for crushing. Clinical significance and types of artificial insemination.

3. Fragmentation: definition of the concept, biological significance, types and their dependence on the type of egg. Fragmentation and formation of blastocysts in humans.

4. Gastrulation: definition of the concept, biological significance, mechanisms and phases. Features of gastrulation in humans.

5. Implantation: definition of the concept, general information, stages, terms.

Task 2. Topics of the essays for the practical lesson:

1. Causes of anomalies and deformities.
2. Modern genetic theory of human embryo development.
3. Theoretical foundations for understanding embryogenesis.
4. Early stages of human embryogenesis.
5. Histo- and organogenesis of the human embryo.
6. Critical periods of human development.
7. Morphofunctional bases of in vitro fertilization.

#### **Topic 4.3. Human provisory organs /Lecture/**

Task 1. Test control questions with answer standards

1) The embryoblast serves as a source for the formation of:



1. chorion and allantois;
2. choriona;
3. the bodies of the embryo, the amnion and the yolk sac;
4. the bodies of the embryo, amnion, yolk sac and allantois;
5. amnion, yolk sac and allantois

2) The trophoblast serves as a source for the formation of:

1. chorion and allantois;
2. choriona;
3. the bodies of the embryo, the amnion and the yolk sac;
4. the bodies of the embryo, amnion, yolk sac and allantois;
5. amnion, yolk sac and allantois

3) Give a name to the processes by which the embryo establishes a connection with the mother's body (uterus):

1. gastrulation, placentation;
2. implantation; placentation;
3. placentation, histogenesis;
4. fertilization, placentation;
5. placentation, intussusception

#### **Topic 4.4. Human pharmacological organs /Practical classes/**

Task 1. Questions for the oral survey:

1. Phylogenetic characteristics of extra-germ organs.
2. Extra-embryonic organs in the early stages of human development. Structure and functional significance of the amnion, yolk vesicle, allantois, and umbilical cord.
3. Types of placentas. Structure and functions of the human placenta. Placental barrier.
4. Critical periods of human development.

Task 2. Examples of tasks with response standards

## Tasks

1) In the process of development, the chorion is differentiated into smooth and villous. Which one is associated with the decidual shell? What extra-germ organ is formed as a result of this connection?

Answer: The villous chorion is connected to the main deciduous (decidual) shell. The placenta is formed.

2) In the early stages of the development of the mammalian embryo, a trophoblast is formed. What tissue is formed from it in the placenta?

Answer: The trophoblastic epithelium is further differentiated into cyto-and symplastotrophoblast.

3) A pregnant woman has a placenta previa in the area of the internal fallopian pharynx. What is the possible reason for this position of the placenta?

Answer: The blastocyst was implanted in the endometrium close to the cervix.

### Topic 4.5. Diagnostics of histological preparations /Self-study/

Task 1. Microscopy of histological preparations (with a description)

1. The fetal part of the human placenta (amnion, chorial villi, interstitial space).
2. The maternal part of the human placenta (basal plate, interstitial space)
3. The umbilical cord (arteries and veins, remnants of allantois).

### Stage: Midterm assessment (exam) 3<sup>rd</sup> term.

Midterm assessment is carried out in the form of exam. Tasks for the exam include two theoretical points for oral quiz and demonstration of practical skills.

Tasks for competence assessment «Knowledge»	Task type
<b>List of theoretical points for oral quiz:</b>  1. Microscopic investigation of cells, tissues and organs. Main stages of production of histological preparation. 2. Cell. Plasma membrane, nucleus and cytoplasm. Characteristics of hyaloplasm and organelles, their classification, ultrastructure, functions. 3. Organelles of cytoplasm, hyaloplasm. Classification of organelles, functions. Ultrastructural characteristics of cytoplasmic membrane and nucleus. 4. Morphological changes in cells during the life cycle. Stem cell. Methods of reproduction and regeneration of somatic cells. Morphology of aging cells.	<b>-theoretical</b>

<p>Necrosis, apoptosis, their morphofunctional characteristics and distinctive features.</p> <p>5. Reactive properties of cells, their importance. Concepts of compensation and decompensation at the cellular and subcellular levels. Sensitivity of cells to damaging factors depending on the degree of differentiation and functional activity.</p> <p>6. Embryonic membranes, their development, structure and transformation in a number of vertebrates (fish, birds, mammals). Main mechanisms of embryogenesis regulation. Concept and examples of a plastic segregation, cell-interaction, embryonic induction, and neuroendocrine regulation.</p> <p>7. Mammalian placenta. Principles of structure. Types of placenta in trophics structure and nature. Functions.</p> <p>8. Ultrastructural characteristics of male and female human germ cells. The progenesis. Stages. Chronology of the process. Spermatogenesis and ovogenesis.</p> <p>9. Early human embryogenesis. Fertilization, cleavage, gastrulation.</p> <p>10. Characteristics of human embryogenesis stages. Biological processes that underlie the stages. The chronology of the processes. Implantation, feature of gastrulation and formation of embryonic membranes, their structure and role in fetal development.</p> <p>11. Human embryogenesis. General regularities and peculiarities of embryogenesis. Extraterrestrial organs: education, structure and functions.</p> <p>12. Human placenta. Umbilical. Development, structure, functions. Mother-placenta system and factors affecting its physiology.</p> <p>13. Critical periods of human embryogenesis. Influence of damaging factors on the fetus.</p> <p>14. Epitheliums. Classification (morphofunctional and histogenetic). Characteristics of epithelial cells. Role of glandular epithelium.</p> <p>15. Glandular epithelium. Source of development. Secretory phase of the cycle. Types of secretion. Concept of endocrine and exocrine glands. Concept of stroma and parenchyma of glands. Principle of exocrine glands structure. Exocrine glands classification of. Features of epithelial lining glands structures of different origin. Stroma and parenchyma possibilities of regeneration of.</p> <p>16. Connective tissue. Classification. Cytophysiological characteristics of cells and intercellular substance. Concept of stroma. Cellular bases of inflammatory reaction and wound healing process. Age change.</p> <p>17. Blood. Plasma and shaped blood elements, their classification, characteristics and functions. Concept of hemogram and leukocyte formula, their value for the clinic.</p> <p>18. Cytophysiology of blood leukocytes and their role in the body's protective reactions. Macrophage mononuclear system. Cellular bases of inflammatory reaction and wound healing process.</p> <p>19. Loose unformed fibrous connective tissue. Cytophysiological characteristics of cells and intercellular substance. Concept of stroma. Cellular bases of inflammatory reaction and wound healing process. Age change.</p> <p>20. Connective tissues with specific properties. Structure, location in the body and function. Regeneration. Development. Mesenchyma, its origin, structure, functions.</p> <p>21. Cartilaginous tissue. Source of development. Principle of structure. Classification. Histophysiology of cartilage tissue types and their distinctive features. Trophies, growth, regeneration.</p> <p>22. Bone tissue. Origin. Principle of structure. Classification. Histophysiology. Structure of the tubular bone as an organ. Structure of compact and spongy bone substance. Trophism. Regeneration.</p> <p>23. Development of bone tissue. Direct and indirect osteogenesis.</p> <p>24. Muscle tissue. Source of development. Classification. Histophysiology of muscle tissue. Physiological and reparative regeneration.</p> <p>25. Striated muscle tissue. Source of development. Histophysiology. The structure of the myofibrils. Structural basis of muscle contraction. Regeneration.</p>	
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26. Nervous tissue. Origin. Principle of structure. Morphofunctional characteristics of neurons and neuroglia. Hematoencephalic barrier. Regeneration of neurons and glia.

27. Nerve fiber. Structure and morphofunctional features of nerve fibers. Regeneration. Structure of the peripheral nerve. Nerve endings in the epithelium, connective and muscle tissues. Synapses. Definition. Classification by structure and function.

28. Peripheral nervous system. Spinal node. Nerve. Histophysiology. Regeneration. Vegetative nervous system.

29. Cerebellum. Structure and functions. Neural afferent and efferent parts of the reflex arc.

30. Cortex of the cerebral hemispheres. Development. Modular organization. Hematoencephalic barrier. Lining of the brain.

31. Embryonic hematopoiesis. Sequence of blood change. Features of hematopoiesis in each organ. Concept of myelopoiesis, myeloid tissue, lymphopoiesis, lymphoid tissue.

32. Characteristics of post-embryonic hematopoiesis. Erythropoiesis. Stages. Regulation of erythropoiesis. Thrombocytopoiesis.

33. Hematopoiesis in the red bone marrow. Granulocytopoiesis, monocytopenoiesis, lymphopoiesis.

34. Red bone marrow. Development. Histophysiology. Interaction of stromal and hematopoietic elements. General characteristics of hematopoiesis parts. Sensitivity to damaging factors of its elements. Age change.

35. Thymus. Development. Histophysiology. Interaction of stromal and hematopoietic elements. Blood-thymic barrier. Age and accidental involution. Role of thymus in immunogenesis.

36. Spleen. Functions. Development. Histophysiology. Its hematopoietic function and participation in protective immunological reactions of the body. Features of blood supply to the spleen.

37. Lymph node. Histophysiology. Participation of lymph nodes in the processes of lymphopoiesis and protective reactions. Regeneration.

38. Structural bases of cellular and humoral immunity. Characteristics of immunocompetent cells and their interaction in the immune response.

39. Skin. Principle of structure. Sources of skin tissue development. Histophysiology of layers. Regeneration. Regional, age and sex characteristics of the skin. Sweat glands of the skin. Location. Structure. Composition of secretion and type of secretion. Functions.

40. Derivatives of skin. Hair. Development. Classification. Histophysiology. Growth, regeneration, hair change. Sebaceous glands. The composition of the secretion and the type of secretion. Functions.

41. Respiratory system. Development. Morphological and functional characteristics of airways. Trachea. Bronchi. Histophysiology. regeneration

42. Lung. Pleura. Histophysiology of the lung. Structure of the respiratory part- acinus function. Features of interstitial. Features of blood supply to the lung. Airways. Classification. Structure of wall and distinctive features of airways different parts.

43. Vessels of microvasculature. Classification. Histophysiology. Capillaries. Features of the structure and function. Arteriolo-venular anastomoses. Regeneration.

44. Blood and lymph vessels. Classification. General principle of vessel wall structure. Relationship of the structure of arteries walls, veins and hemodynamic conditions. Organospecific features of arteries and veins.

45. Heart. Development. The wall structure, fabric composition of shells. Regeneration. Cardiac conduction system.

46. Organs of the oral cavity. Principle of the oral mucosa structure. Fabric composition. Tongue. Histophysiology of the tongue dorsal surface. Regeneration.

47. Salivary glands. Source of development. Histophysiology. Types and structure of secretory parts, intra-and inter-lobular ducts. Features parotid, submandibular and sublingual glands. Regeneration and age-related features.

48. Teeth. Anatomical and histological structure of hard and soft parts of a tooth. Regenerative features of the dental tissues Age-related changes. Development of teeth. Change of generation of teeth, causes.

49. Pharynx and esophagus. Development. Histophysiology. Regeneration.

50. Stomach. Development. Features of the histophysiology of different departments. Structure and cytochemical characteristics of glands in different parts of the stomach. Regeneration. Age features.

51. Intestine. Bowel movements. Development. The principle of the wall structure. Tissue and cell composition of the membranes. Morphofunctional features of the structure of intestinal membranes of thin and thick sections. Regeneration, blood supply, innervations. Organs of the immune defense of the intestine. General morpho-functional characteristics and individual features. Age change.

52. Pancreas. Development. Histophysiology of exocrine and endocrine departments. Regeneration. Perfusion. Age change.

53. Liver. Development. Functions. General principle of the structure. Morphological and functional characteristics of hepatic lobules. The concept of a portal lobe and acinus, a triad. Ultrastructure of hepatocytes and cells lining sinusoidal capillaries. Hepatic barrier, its role. Regeneration.

54. Structural bases of bile formation. Bile passages. Gallbladder. Histophysiology. Regeneration.

55. Pituitary. Development. Histophysiology of adeno- and neurohypophysis. Hypothalamic-pituitary connection. Regeneration. Age change.

56. Thyroid and parathyroid glands. Source of development. Histological structure of the thyroid and parathyroid glands. Vascularization. Functions of hormones of glands in regulation of general and mineral metabolism. Regulation of activities. Regeneration. Age-related changes and sensitivity to adverse factors.

57. Adrenal. Development. Functions. Histophysiology of cortical and brain matter. Regulation of hormone synthesis. Age change.

58. Kidney. Development. Structure of nephron. Histophysiology of cortical and brain matter. Stages and regulation of urination. Peculiarities of blood supply of cortical and juxtamedullary nephrons. Endocrine apparatus of kidney. Regeneration.

59. Urinary tract. Development. Ureters, bladder. Histophysiology. Regeneration.

60. Testicle. Development. Histophysiology. Reproductive function (spermatogenesis). Endocrine function. Regulation. Age change.

61. Additional glands of the male reproductive system. Structure. Prostate. Histophysiology of secretory departments and excretory ducts. Stroma feature. Exocrine and endocrine functions. VAS deferens. Principle of the wall structure.

62. Ovary. Development. Histophysiology of cortical and brain matter. Ovarian cycle. Development of the yellow body. Regulation of their activities. Follicular atresia. Age change.

63. Uterus, ovaries, vagina. Histophysiology. Ovarian-menstrual cycle. Age change.

64. Breast. Source of development. Histophysiology. Characteristics of the stroma and parenchyma of the lactating and non-lactating gland. Dependence of structure and functioning on neuroendocrine regulation of mammary glands. Changes in the mammary glands during the ovarian-menstrual cycle and during pregnancy. Age change.

65. Eye. Development. Histophysiology of eyeball membranes. Regeneration.

66. Accommodative system of the eye. Lens, ciliary body, iris. Development, structure, functions.

<p>67. Organ of hearing. Development. Outer, middle, inner ear. Histophysiology of the bone and webbed labyrinth of the inner ear. Structure of the receptor zone. Theory of sound perception.</p> <p>68. Body balance. Inner ear. Osseous and membranous labyrinths. Histophysiology. Structure of sensory scallops and sensory spots, their role.</p>	
<p><b>Tasks for competence assessment «Abilities»</b></p>	<p><b>Task type</b></p>
<p>Tasks for Demonstration of practical skills (characteristics of microslides):</p> <ol style="list-style-type: none"> <li>1. The mesothelium of the gland.</li> <li>2. Blood smear.</li> <li>3. Loose unformed connective tissue.</li> <li>4. Cross-sectional tendon.</li> <li>5. Fibrocartilage.</li> <li>6. Elastic cartilage.</li> <li>7. Lamellar bone tissue on the example of a cross-section of the tubular bone.</li> <li>8. Hyaline cartilage of the trachea.</li> <li>9. Bone development from the mesenchyme.</li> <li>10. Cross-striped muscular tissue of the tongue.</li> <li>12. Central pontine myelinolysis.</li> <li>13. Neuro-vascular bundle.</li> <li>14. Spinal ganglion.</li> <li>15. Spinal cord.</li> <li>16. Cerebellum.</li> <li>17. Cortex of the cerebral hemispheres.</li> <li>18. Longitudinal incision of the inner ear.</li> <li>19. Cornea.</li> <li>20. Back wall.</li> <li>21. Arterioles, venules, capillaries of the soft meninges.</li> <li>22. Artery of elastic type-aorta.</li> <li>23. Wall of the heart.</li> <li>24. Lymph node.</li> <li>25. Spleen.</li> <li>26. A swab of red bone marrow.</li> </ol>	<p>-practical</p>

<p>27. Red bone marrow in the bone cavities of flat bones.</p> <p>28. Thyroid.</p> <p>29. Pituitary.</p> <p>30. Red bone marrow in the bone cavities of the flat bone.</p> <p>31. Adrenal.</p> <p>32. Thymus.</p> <p>33. The skin of the finger.</p> <p>34. Skin and hair.</p> <p>35. Lactating mammary gland.</p> <p>36. Lip.</p> <p>37. Leaf-shaped papillae of the tongue.</p> <p>38. Filamentous papillae of the tongue.</p> <p>39. Development of teeth.</p> <p>40. The development of teeth. Germ of tooth. Late stage.</p> <p>41. Palatine tonsil.</p> <p>42. Protein parotid salivary gland.</p> <p>43. A cross-section of the esophagus.</p> <p>44. The bottom of the stomach.</p> <p>45. Pyloric part of the stomach.</p> <p>46. Duodenum.</p> <p>47. Jejunum.</p> <p>48. Colon.</p> <p>49. Liver of a pig.</p> <p>50. Human liver.</p> <p>51. Pancreas.</p> <p>52. Cross-section of the transverse section of a tooth.</p> <p>53. Trachea.</p> <p>54. Lung.</p> <p>55. Epiglottis.</p> <p>56. Kidney of the rat.</p>	
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57. Ureter.	
58. Bladder.	
59. Testis.	
60. Appendage of testis.	
61. Prostate.	
62. Ovary.	
63. Oviduct.	
64. Yellow body.	
65. Uterus of mammals.	

## METHODOLOGICAL GUIDELINES FOR LEARNING OUTCOMES ASSESSMENT

### Stage: Formative assessment

Formative assessment is a regular checking of student academic progress during the academic term. It is performed in various oral and written forms (quizzes, essays, checking of home assignments, compilation of cases, self-study, colloquiums, and testing). During formative assessment, the teacher monitors the level of student's academic progress according to the curriculum identifying lack of knowledge, or misunderstanding.

The tasks of formative assessment are aligned with the Curriculum and Syllabus.

### 1. Guidelines for assessing the oral quiz:

In assessing the teacher takes into account:

- knowledge and understanding of the subject matter;
- activity during the class;
- consistency of presentation;
- argumentation of the answer, the level of independent thinking;
- ability to link theoretical and practical principles with future professional activity.

### Assessment criteria:

The results are assessed in a four-grading scale: "excellent", "good", "satisfactory", "unsatisfactory".



Type of the task	Assessed competences	Assessment criteria	Grade
<b>Oral quiz</b>	GPC – 5.1 GPC – 5.2 GPC – 5.6	<p>The student demonstrates a comprehensive, systematic and in-depth knowledge of the academic material; has learned the required and additional resources.</p> <p>The student demonstrates a consistent and thorough understanding of the required knowledge, concepts, skills of the material learned, and their significance for future profession.</p>	Excellent
		<p>The student demonstrates a comprehensive knowledge of the academic material; has learned the required and additional resources. The student demonstrates a consistent understanding of the required knowledge, concepts, skills of the material learned, but makes minor errors.</p>	Good
		<p>The student demonstrates basic knowledge necessary for further study; has learned basic recommended literature.</p> <p>The student operates with inaccurate formulating, has difficulties in the independent answers, makes significant mistakes but is able to correct them under the guidance of a teacher.</p>	Satisfactory
		<p>The student does not know the obligatory minimum or demonstrates gaps in knowledge of the academic material, makes major mistakes or gives completely wrong answers.</p>	Unsatisfactory

## 2. Guidelines for case-study assessment:

### Assessment criteria:

The results are assessed in a four-grading scale: “excellent”, “good”, “satisfactory”, “unsatisfactory”.

Type of the task	Assessed competences	Assessment criteria	Grade
Case - study	GPC – 5.1 GPC – 5.2 GPC – 5.6	The student correctly and solves the case-study task, demonstrating deep knowledge. There are no errors in logical reasoning and solution, the problem is solved in a rational way. The right answer is obtained; ways are clearly described.	Excellent
		The student correctly solves the case-study task, demonstrating deep knowledge. There are minor errors in logical reasoning and solution, the problem is solved in a rational way. The right answer is obtained, ways are clearly described.	Good
		The student correctly solves the case-study task, demonstrating basic knowledge. There are significant errors in logical reasoning and solution. The student demonstrates difficulties, but still is able to solve a case-study task.	Satisfactory
		The student incorrectly solves the case-study task, makes significant mistakes. The student is not able to solve a case-study.	Unsatisfactory

### 3. Guidelines for test assessment.

#### Assessment criteria:

The results are assessed in a four-grading scale: “excellent”, “good”, “satisfactory”, “unsatisfactory”.

Type of the task	Assessed competences	Assessment criteria	Grade
Test	GPC – 5.1 GPC – 5.2 GPC – 5.6	80 – 100%	Excellent
		66 – 80%	Good
		46 – 65%	Satisfactory
		Less Than 46%	Unsatisfactory

### 4. Guidelines for the assessment of practical skills:

Assessment of practical skills based on simulation or participation of third parties may include a demonstration of manipulation, response to the questions of the task;

- assessment of practical skills at the bedside may include a demonstration of detection and / or interpretation of signs, symptoms, methods of examination and treatment;

-the task may include a brief introduction, questions, and list of practical skills for demonstration (according to Curriculum).

In assessing the teacher takes into account:

- knowledge and understanding of the subject matter;

- ability to apply theoretical knowledge into practice;

- the level of formed practical skills;

- reasoning and response style;

- rationale for data selection, additional tests, differential diagnosis and/or choice of treatment, level of clinical thinking.

**Assessment criteria:**

The results are assessed in a four-grading scale: “excellent”, “good”, “satisfactory”, “unsatisfactory”.

Type of the task	Assessed competences	Assessment criteria	Grade
Practical skills	GPC – 5.1 GPC – 5.2 GPC – 5.6	The student correctly demonstrates practical skills on the model with a deep knowledge of the material. There are no mistakes in the demonstration and the used technique. The indications and conditions used in this method are clearly described.	Excellent
		The student demonstrates practical skills on the model with slight inaccuracies. There are insignificant mistakes in the demonstration and the used technique. The indications and conditions used in this	Good

		method are clearly described.	
		The student demonstrates practical skills on the model with inaccuracies. There are significant mistakes in the demonstration and the used technique. The indications and conditions used in this method are clearly described.	Satisfactory
		The student demonstrates practical skills on the model with significant mistakes. The indications and conditions used in this method are not described.	Unsatisfactory

### 5. Essay requirements:

1) Volume: 1500-300 words,

2) Contents structure:

- Introduction
  - prove the relevance of the chosen topic
  - point out the purpose of the essay
  - give a summary of the main points
- Body
  - use information obtained from different sources during the research
  - show inaccuracy of the opposite points of view
- Conclusion
- List of references

The essay assumes usage of several specialized sources (at least 8-10 publications, monographs, the reference media, manuals). Preference is given to the publications in specialized medical journal and monographs including foreign databases.

**Assessment criteria:**

The results are assessed in a four-grading scale: “excellent”, “good”, “satisfactory”, “unsatisfactory”.

<b>Type of the task</b>	<b>Assessed competences</b>	<b>Assessment criteria</b>	<b>Grade</b>
Essay	GPC – 5.1 GPC – 5.2 GPC – 5.6	<p>The requirements are fulfilled:</p> <ul style="list-style-type: none"> <li>- the problem is formulated and its relevance is proved;</li> <li>- the various approaches to problem are presented;</li> <li>- conclusions are formulated;</li> <li>- the subject is thoroughly studied;</li> <li>- volume is observed;</li> <li>- design requirements are observed;</li> <li>- correct answers to additional questions are given.</li> </ul>	Excellent
		<p>The essay is fulfilled with some mistakes:</p> <ul style="list-style-type: none"> <li>- inaccuracies in material statement;</li> <li>- no logical sequence in judgments;</li> <li>- volume is not observed;</li> <li>- errors in design requirements;</li> <li>- incomplete answers are given to additional questions in the process of defense.</li> </ul>	Good
		<p>There are significant deviations from requirements:</p> <ul style="list-style-type: none"> <li>- topic is only partially explored;</li> <li>- mistakes in contents of the paper;</li> <li>- mistakes in answers to additional questions;</li> <li>- no conclusion is given at the process of defense.</li> </ul>	Satisfactory
		<p>The essay is not prepared at all.</p> <p>The subject of the essay is not explored, significant misunderstanding of a topic.</p>	Unsatisfactory

**Stage: midterm assessment (exam)**

**Methodological guidelines for midterm assessment (exam)**

**Examination is held in the oral form and includes several stages:**

- oral answer (the card includes two questions);
- demonstration of practical skills.

**Requirements for the student:**

- 1) regularly attend classes; the absence from classes is not allowed without good reason;
- 2) in case of absence from classes the student has to work out passed classes;
- 3) the student has to hand over written papers on time;
- 4) the student has successfully passed all colloquiums provided by the plan;
- 5) in case the student has been negatively assessed on the colloquium, he/she should try to pass it again;
- 6) during the test week the student has to hand over all the tasks (clinical case).

The students are allowed to take examinations in case of all the tests passed and no academic debts (on the basis of the academic records).

The students are not allowed to take examination:

- with unpassed tests on the discipline;
- with missed classes, debts on the discipline;
- with 5 (five) and more debts for the previous term;
- with one debt for earlier terms for more than a year.

**Recommendations for the examination assessment:**

Type of the task	Assessed competences	Assessment criteria	Grade
Oral answer	GPC – 5.1 GPC – 5.2 GPC – 5.6	The student demonstrates comprehensive, systematic and profound knowledge of the subject, can independently perform the tasks provided by the program; who has a good knowledge of the	Excellent

		<p>main literature and familiar with the additional literature recommended by the program; demonstrates creative abilities in understanding, statement and use of material of the studied discipline, faultlessly answers not only questions of the card, but also additional questions within the main program, correctly performs a practical task.</p>	
<p>GPC – 5.1 GPC – 5.2 GPC – 5.6</p>	<p>The student has good knowledge of material of the studied discipline; can successfully perform the tasks provided by the program; has a good knowledge of the main literature recommended by the program; answers all questions of the card, correctly performs a practical task, but makes some mistakes.</p>	<p>Good</p>	
<p>GPC – 5.1 GPC – 5.2 GPC – 5.6</p>	<p>The student demonstrates knowledge of material for further study; can cope with the tasks provided by the program; familiar with the main recommended literature; makes mistakes when performing examination tasks, but has necessary knowledge for their elimination under the supervision of the teacher.</p>	<p>Satisfactory</p>	

	<p>GPC – 5.1</p> <p>GPC – 5.2</p> <p>GPC – 5.6</p>	<p>The student demonstrates poor knowledge of the material, makes significant mistakes in performance of the tasks provided by the program.</p>	<p>Unsatisfactory</p>
<p>Practical skills</p>	<p>GPC – 5.1</p> <p>GPC – 5.2</p> <p>GPC – 5.6</p>	<p>The student correctly demonstrates practical skills on the model with a deep knowledge of the material. There are no mistakes in the demonstration and the used technique. The indications and conditions used in this method are clearly described.</p>	<p>Excellent</p>
	<p>GPC – 5.1</p> <p>GPC – 5.2</p> <p>GPC – 5.6</p>	<p>The student demonstrates practical skills on the model with slight inaccuracies. There are insignificant mistakes in the demonstration and the used technique. The indications and conditions used in this method are clearly described.</p>	<p>Good</p>
	<p>GPC – 5.1</p> <p>GPC – 5.2</p> <p>GPC – 5.6</p>	<p>The student demonstrates practical skills on the model with inaccuracies. There are significant mistakes in the demonstration and the used technique. The indications and conditions used in this method are clearly described.</p>	<p>Satisfactory</p>
	<p>GPC – 5.1</p> <p>GPC – 5.2</p> <p>GPC – 5.6</p>	<p>The student demonstrates practical skills on the model with significant mistakes. The indications and conditions used in this</p>	<p>Unsatisfactory</p>



		method are not described.	
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**Chart of the examination grade assessment:**

<b>Tasks</b>	<b>Assessed competences</b>	<b>Grade</b>	<b>Score</b>
Theoretical point № 1 (Oral answer)	GPC – 5.1	Excellent	5
	GPC – 5.2	Good	4
	GPC – 5.6	Satisfactory	3
		Unsatisfactory	2
Theoretical point № 2 (Oral answer)	GPC – 5.1	Excellent	5
	GPC – 5.2	Good	4
	GPC – 5.6	Satisfactory	3
		Unsatisfactory	2
Practical task (case studies)	GPC – 5.1	Excellent	5
	GPC – 5.2	Good	4
	GPC – 5.6	Satisfactory	3
		Unsatisfactory	2
Total	GPC – 5.1	Excellent	14-15
	GPC – 5.2	Good	12-13
	GPC – 5.6	Satisfactory	9-11
		Unsatisfactory	1-8