Стом-21 ИН

Federal State Budgetary Educational Institution of Higher Education

«North-Ossetia State Medical Academy»

of the Ministry of Healthcare of the Russian Federation

(FSBEI HE NOSMA MOH Russia)

Department of Biology and Histology

WORKBOOK

for practical classes and extracurricular independent work of students

in the discipline **"Histology, embryology, cytology-oral histology»**

Part I

1st year student _ _ _ _ _ _ group

Faculty of Dentistry

TOPIC: CALL. NON-CELLULAR STRUCTURES.
PC-9

I. Motivational characteristics of the topic.
The cell and the non-cellular structures that form as a result of their vital activity are the basis of the structure and functioning of the organism. Internal and external factors (hormones, medications, etc.) can cause changes in the structure and function of cells, which leads to the occurrence of morphofunctional changes in organs and systems. Studying the microscopic structure of cells taken during life (biopsy) or from a corpse (autopsy) helps the doctor clarify the diagnosis. Cytological examinations of blood, bone marrow, spleen, liver, kidneys and other organs are widely used in the clinic. In this regard, the future doctor needs to know the morphological and cytochemical characteristics of cells and non-cellular substances.

II.Targets.
1. Know the structure of the cell on a microscopic level. Be able to recognize the nucleus and cytoplasm. Be able to identify cells of various shapes in relation to the function performed.
2. Explain the molecular structure of the cell membrane.
3. Explain the differences in the structure of the free and contact surface of the cell.
4. Explain the structure of structures formed with the participation of plasmolemma during absorption of substances-pinocytose vesicles, phagosomes.

III.Required initial level of knowledge
a) from previous topics (biology):
1. General organization of the cell.
2. Chemical composition and basic properties of protoplasm.
3. Basic life properties of protoplasm.

b) from the current session:
1. The definition of the cells. Cell theory.
2. The concept of a biological membrane. Plasmolemma and its derivatives.
3. Methods of penetration of substances into the cell.
4. The shape of cells and nuclei.
5. Types of non-cellular structures.

IV.Information part.
The basis of the structure of eukaryotic organisms is the cell (cellula).
A cell is an ordered structured system of biopolymers that form the nucleus and cytoplasm and participate in a single set of metabolic and energy processes that maintain and reproduce the entire system as a whole.
The elements of the tissue system are: the cell and non-cellular tissue structures (simplast, syncytium, intercellular substance). The shape of cells and their nuclei are diverse and related to the function performed. For example, a red blood cell is a discocyte without a nucleus; smooth myocytes are spindle-shaped with a rod-shaped nucleus; a nerve cell is star - shaped, has appendages, and the nucleus is round.
The cell membrane consists of a bilipid layer, proteins (integral, semi-integral, primembrane), and a carbohydrate supramembrane complex-glycocalyx
Intercellular connections (contacts) provide intercellular interactions. There are: simple connections, desmosomes, slotted connections (nexuses), synaptic connections (synapses).
Any tissue is a complex system, the elements of which are cells and their derivatives.
A tissue is a particular system of an organism arising during evolution, consisting of one or more cell differons and their derivatives, which has specific functions due to the cooperative activity of all its elements.
In the human body, there are the following tissues: epithelial; blood and lymph; connective; muscle; nerve.
In addition to cells in the composition of tissues, there are non-cellular tissue structures. Among them there are cellular derivatives (syncytium and symplast) and the extracellular matrix.
Simplast is a highly differentiated type of cytoplasm with a large number of nuclei. Cellasto built of striated skeletal muscle tissue.
Syncytium (Societe) - joined to one another by cytoplasmic bridges cells. The mesenchyma and reticular tissue are constructed on the principle of syncytium.
The intercellular substance located between the cells, consists of fibers and ground substance. The main substance can be represented by Sol, gel, or be mineralized. Intercellular substance is a part of connective tissues.

V. objects of study.
a) micro-products for self-study:
1. Cubic and prismatic tubules of the kidney (color hematoxylin-eosin).
2. Fusiform smooth muscle cell (hematoxylin-eosin color).

3. Process nerve cell of the spinal cord (silver nitric acid staining)
4.Loose fibrous connective tissue (stained with iron hematoxylin)
5.Tongue (iron hematoxylin staining)
6.Mesenchyme of the embryo (staining with iron hematoxylin)

VI.Learning activity.
1. Using the classroom tables, learn to identify the following cell forms in microparticles:
a) cubic or prismatic form in the preparation " kidney tubules »
b)fusiform form in the preparation " wall of the bladder»
c) sprouted stellate cell in the preparation " spinal cord»
2. On the micro-product "Loose fibrous connective tissue" find and draw the fibrous components and the main amorphous substance located between the cells.
3. On micropreparative "Language" to find and sketch the symplast.
4. On the micro-product "Mesenchyma of the embryo" to find and draw syncytium.
5.Draw and mark drawings:

VII.Control question.
1.Give the definition of the cell. What elements are the tissues of animal organisms made of?
2.The main provisions of the cell theory.
3.List the forms of cells and their nuclei in relation to the function performed.
4.What is the cell surface? Describe the molecular structure of the biological membrane.
5 What is the difference between passive transport of substances through the plasmolemma and active transport?
6. What is the difference between a dense compound and a desmosome? What do You think the cells will have one or the other contact? Link the structure to the function.
7.What is the difference between a slotted connection (nexus) and a synaptic one? What do You think the cells will have one or the other contact? Link the structure to the function.
8.Name the non-cellular structures. In which tissues they function.

VIII.Learning objective.
1.The cell was treated with substances that violate the conformation of proteins that make up the cytolemma. What functions of cellular superficiality will be disrupted?
2.It is known that in tissue culture, cells can attach to the substrate and form cellular aggregates. What cell structures are involved in this?
3.Outside the cytoplasm, there are ions whose concentration inside the cell is greater than outside. Is it possible for these ions to enter the cell? If possible, what is the mechanism?

INDEPENDENT WORK
II.THE STUDENT SHOULD KNOW:

1.Cell structure . The main provisions of the cell theory. 2.Structure of the cell membrane. Intercellular contacts. 3. Non-cellular tissue structures.	1.Histology under the editorship of YUI. Afanasiev, N. A. Yurinsky. - Moscow, 2006. 2. Methodological guide for students in histology. Part 1. L. A. Akoeva, L. A. gireeva, L. S. Tabolova, and others. Vladikavkaz, 2008. 3.Cytology. L.A. Akoeva.,L, A, gireeva, L. S. Tabolova et al. Vladikavkaz, 2004.

II. THE STUDENT MUST BE ABLE TO:
1.Identify cells of various shapes in relation to the function performed.
2.Explain the differences in the structure of the free and contact surface of the cell.

I. Tasks to prepare for the lesson:
Task 1. Fill in the table «composition of the cell plasmolemma»

components	% relation	kinds	localization
protein			

Task 2. Continue with the keywords and fill in the tables.

The plasmolemma performs numerous functions. 1. Support function	The membrane participates in cell formation: elements of the intracellular skeleton (microtubules, microfilaments, and intermediate filaments) are attached to it.
2. function	On the outside of the plasmolemma, there may be specific proteins-receptors for biologically active substances - hormones, mediators, and antigens.
3. Interaction with other cells	
4. …… function	Due to its lipid bilayer, the membrane is impervious to many substances (hydrophilic compounds and ions), i.e. it effectively separates the cytoplasm from the extracellular environment.
5. ……. function	

Transfer of low-molecular substances through the plasmolemma (regardless of its direction-inside the cell or out of it) can be carried out in three ways. The table names the processes. Name these methods.

1.	a) this is an independent penetration of substances through the membrane along the concentration gradient. b) so pass small neutral molecules (H2O, CO2 , O2) and low-molecular hydrophobic organic substances (fatty acids, urea).
2. Easy diffusion	a) here the substance passes through the membrane also along the gradient of its concentration, but with the help of a special protein - translocase. b) Molecules of the latter usually permeate the membrane, forming transport channels in it,

Transfer of large compounds and particles to the cell (endocytosis)
Here, too, you can distinguish 3 varieties. Explain what each method means.

1. Pinocytosis	
2. Phagocytosis	
3. Receptor-mediated endocytosis	

Task 3. Make 2-3 test tasks based on the sample.
Glycocalyx. (Choose the correct answer)
1. It is located in the smooth endoplasmic network.
2. It is located on the outer surface of the cytolemma.
3. Formed by carbohydrates.
4. It is involved in cell adhesion and cell recognition.

5. It is located on the inner surface of the cytolemma.

Questions for self-monitoring:
1.Give the definition of the cell. What elements are the tissues of animal organisms made of?
2.The main provisions of the cell theory.
3.List the forms of cells and their nuclei in relation to the function performed.
4.What is the cell surface? Describe the molecular structure of the biological membrane.
5.Types of cellular contacts.
6.Name the non-cellular structures.

TOPIC: CALL. CYTOPLASM. THE CORE. CELL DIVISION.
PC-9

I. Motivational characteristics of the topic.
See lesson. "Cytology I. Cell and non-cellular tissue structures. Cell membrane».

II.Targets.
1.Know the structure and function of cell organelles on a microscopic level. 2.To be able to identify them on the basis of the structural and cytochemical features.

3.Know the structure of various types of organelles at the microscopic level. 4.To be able to identify them on the basis of the structural and cytochemical features.
5.Be able to use specific data about the structure and chemical composition
organelles and inclusions for the characteristic of metabolism and functional state of cells.
6.Know the structure and functions of the nucleus at a microscopic level. Be able to determine the structural components of the nucleus based on their structural and cytochemical features.
7. Explain the role of the nucleus in protein synthesis.

III.The required initial level of knowledge.
a) from the previous topics:
1. The definition of the cells. General plan of the cell structure.
2. Structure of the biological membrane.
3. Tinctorial properties of the kernel.
b) from the current session:
1. Principle of the cytoplasm membrane structure.
2. Classification of organelles, their structure and functions.
3. Classification of organelles, their structure and functions.
4.Core functions. Structure of the core in the interphase.

IV.Object of study.
a) micro-Products
1. Spinal node (painted with silver nitric acid)
2. Kidney tubules (hematoxylin-eosin color)
3. The inclusion of fat in the liver cells (staining with Carmine)
4. Inclusion of glycogen in the liver cell (best color)

V. Information part.
All eukaryotic cells consist of two main components - the cytoplasm and the nucleus.
The cytoplasm is separated from the environment by a plasmolemma and consists of hyaloplasm, organelles, and inclusions. Hyaloplasm-is the internal environment of the cell; it is a complex colloid system that includes various biopolymers: proteins, nucleic acids, polysaccharides, etc.This system is able to move from the ash-like state to the gel-like state and back.
Organelles are constantly present and mandatory for all cells microstructures that perform vital functions.
There are membrane organelles(mitochondria, endoplasmic reticulum, Golgi apparatus, lysosomes) and non-membrane organelles (free ribosomes and polysomes, microtubules, centrioles).
Membrane organelles are single or interconnected compartments of the cytoplasm, separated by the membrane from the surrounding hyaloplasm, having their own contents, different in composition, properties and functions from other parts of the cell. In the hyaloplasm, the membrane organelles are distributed naturally. The endoplasmic network and various vacuoles arising from it constitute the vacuolar system of substance transport. In addition, it includes the Golgi complex, lysosomes, and autolysosomes. For all elements vakuoljami system is characterized by

the presence of a single bounding membrane. Mitochondria are separated from the hyaloplasm by two membranes (two-membrane organelles).
By functional value, organelles are classified into: organelles of General significance (present in all cells and provide vital processes, such as EPS, mitochondria, ribosomes, etc.) and special significance (present in certain cells and provide specialized functions, such as myofibrils, neurofibrils, cilia, microvilli).
Inclusions are optional components of a cell that appear and disappear depending on the metabolic state of the cells. According to the functional value, there are trophic, secretory, excretory and pigment inclusions. By chemical composition, inclusions are protein, fat, and carbohydrate.
The cell nucleus is a system of genetic determination and regulation of protein synthesis.
The nucleus consists of chromatin, the nucleolus, karyoplasm (nucleoplasm) and the nuclear envelope.
Karyoplasm is the internal environment of the nucleus.
Chromatin of interphase nuclei is a chromosome that is in an active working state-partially or completely decondensed. Zones of complete decondensation are called euchromatin. Areas of condensed chromatin (incomplete loosening of chromosomes) are called heterochromatin. The chemical composition of chromatin-DNA: protein: RNA is 1:1,3:0,2.
The nucleolus is the densest structure of the nucleus, it is a derivative of the chromosome, one of its loci with the highest concentration and activity of RNA synthesis in the interphase. The nucleolus is the site of R - RNA and ribosome formation.
The nuclear envelope consists of an outer and inner membrane separated by a perinuclear space (the nuclear envelope cistern). The nuclear envelope contains nuclear pores.
The structural and functional changes of a cell over time make up its cell cycle - the period from cell division to division or from division to death.
The cell cycle consists of: mitosis proper (M), presynthetic (G1), synthetic (S), and postsynthetic periods (G2).
G1-period: accumulation of cellular proteins, preparation of the cell for DNA synthesis.
S-period: doubling the amount of DNA per core, the level of RNA synthesis increases accordingly to the increase in the amount of DNA.
G2-period: mRNA synthesis, ribosome rRNA is already present, and RNA synthesis drops sharply by the end of the period.
M-period: consists of the following phases:
1. prophase (centrioles at the poles, the formation of the fission spindle begins)
2. metaphase (chromosomes line up at the equator, the formation of the division spindle ends)
3. anaphase (movement of chromosomes to opposite ends of the cell)
4. telophase (starts with stop dispersed chromosomes and ends with the reconstruction kernel and catatonia - cell division)

VI.Learning activity.
1.Find and draw large round-shaped nerve cells on the "Spinal node" micropreparation(1). In the center of the cells is a light rounded nucleus(2), near which the black Golgi complex membranes are clearly defined (3).
2.On the micro-product "kidney Tubules" find and draw cross-cut tubules(1), the wall of which is formed by high cylindrical cells(2), a large number of dark orange mitochondria in the form of short sticks(3) is determined throughout the cytoplasm.
3.On the micro-product "Inclusions of fat in liver cells" find and draw polygonal cells(1) in the cytoplasm(2) which are determined by black fat granules(3).
4.On the micro-product "glycogen Inclusions in the liver cell" find and draw polygonal cells (1) in the cytoplasm of which (2) bright red blocks of glycogen(3) are determined.
5. Draw and mark drawings:

VII.Control question.
1.What is cytoplasm? Hyaloplasm, chemical composition, functions.
2.What are organelles? Classification of organelles.
3.Cell membrane organelles, structure, functions.

4.Non-cellular organelles, structure, functions.
5.What are inclusions? Types, structure, and functions .
6.List the structural components of the interphase core. Their structure and functions.
7.Name the structural components of chromosomes. What is a gene, chromosome set, and sex chromatin?What is hetero - and euchromatin?

VIII.Learning objective.
1.The person got into the atmosphere, saturated with the vapors of the CSI я poison; the body was poisoned. One of the main morphological manifestations of this process was a violation of the integrity of the liver cell lysosome membranes. What will be the result of the effect of the poison on the cell, if the integrity of most lysosomes is violated?
2.The Golgi complex was removed from the cell using a micromanipulator? How will this affect her future life?
3.The cell was treated with colcemide , a substance that destroys microtubules and microfilaments. What cell functions will be affected?
4.By the method of electronic histochemistry, it was established that rosette-like structures containing glycogen can appear and disappear in the cytoplasm of liver cells in the course of vital activity. What are these cell structures called?
5.In the cytoplasm of pigment cells, under the influence of sunlight, pigment granules appear. What structural elements of the cell can these granules be attributed to?
6.When examining various cells under an electron microscope, it was found that some on the surface have single microvilli, while others have a brush border. What conclusion can be drawn about the function of these cells?
7.The animal starved for a long time, but at the same time performed intensive physical activity. When studying the state of liver and heart cells, the following was found: an increase in the number of primary lysosomes, a decrease in the stability of lysosome membranes (an increase in the content of secondary lysosomes and autophagosomes). Can autophagic vacuoles appear in cells under normal conditions of life of the body? What cell structures can be part of autophagic vacuoles? Why are there many autophagic vacuoles during fasting and physical work?
8.It is known that the General principle of the structure of all the membranes that make up the various cell organelles is the same. How can we explain the specific functions of each organelle?
9.When analyzing a "healthy" organ, small sections of the cytoplasm were found in some cells, bounded from the rest of the membrane and containing sharply altered mitochondria and fragments of the cytoplasmic network. Can cells containing the described structures be considered "healthy" or not? With the participation of which organelles and how did these areas arise?
10.On the free surface of cells, structures are detected in which 9 pairs of peripheral and 2 pairs of Central microtubules are visible under an electron microscope. What are these structures called? What function do they perform?
11. On preparations, there is a decrease in the size of cell nuclei, their compaction, shrinking, and more intense chromatin staining than in unchanged nuclei. What is the name of this phenomenon?
12.As a result of mitosis, two daughter cells were formed. One of them enters the stage of the cell cycle, the second, as a result of differentiation, has lost the ability to reproduce. What is the ultimate fate of each cell?
13.In the area of the wound surface appears a large number of cells containing primary lysosomes, many phagosomes and secondary lysosomes. What is the functional significance of these cells?

INDEPENDENT WORK

I.THE STUDENT SHOULD KNOW:

1.Hyaloplasm, chemical composition, role in the cell. Structure and functions of cell organelles. 2.Structure and functions of the core. The role of the nucleus in protein synthesis. Features of the main phases of mitosis. The life cycle of cells	1.Histology under the editorship of YUI. Afanasiev, N. A. Yurinsky. - Moscow, 2006. 2.Methodological guide for students in histology. Part 1. L. A. Akoeva, L. A. gireeva, L. S. Tabolova, and others. Vladikavkaz, 2008. 3.Cytology. L. A. Akoeva.,L, A, gireeva, L. S. Tabolova et al. Vladikavkaz, 2004.

II. THE STUDENT MUST BE ABLE TO:
Determine at the microscopic level different types of organelles and inclusions based on their structural and cytochemical features.
III. Tasks to prepare for the lesson:
Task № 1. Fill in the table «structural components of the cell»
The cytoplasm consists of the following components:

1. Hyaloplasm (cytosol)	a) Hyaloplasm is constitute
2. Organelles	b)Organelles are called
3. Inclusions	c)They are divided in to two types

Task №2. Fill in the table "cell Organoids".

Name of the organoid	Structure features	Functions
Granular ER		
Agranular ER		
The Golgi body		
Mitochondria		

Task №3.Continue your sentences.

Core functions:
A) in somatic cells
1.Saves …….for transmission to child cells.
2.Provides …….
B) in the germ cells.....
3.Preparation of genetic material for .....
Chromatin is…

Types of chromatin	function
Heterochromatin	

One of the components of heterochromatin can be sex chromatin. In men, the set of chromosomes in each cell contains..... They are located in ... .condition. The women in the cells contained..., ...condition. Sexual chromatin is detected in ..... vide.
The nucleolus is ....., it is formed..... and contains.... ……...Is going on here .....

Task № 4. Make 2-3 test tasks based on the sample.
In the formation of lysosome enzymes involved:
1. granular EPS
2. smooth EPS
3. the Golgi complex

4. lysosomes

IV. Questions for self-monitoring
1.Give the definition of the cell. What elements are the tissues of animal organisms made of?
2.The main provisions of the cell theory.
3.List the forms of cells and their nuclei in relation to the function performed.
4.What is the cell surface? Describe the molecular structure of the biological membrane. Types of cellular contacts. Name the non-cellular structures.
5.What is cytoplasm? Hyaloplasm, chemical composition, functions.
6.What are organelles? Classification of organelles. Cell membrane organelles, structure, functions. Non-membrane cell organelles, structure, functions.
7.What are inclusions? Types, structure, and functions.
8.List the structural components of the interphase core. Their structure and functions. What is hetero - and euchromatin? Name the structural components of chromosomes. What is a gene, chromosome set, and sex chromatin?
9. What is the cell cycle? What are the differences between the mitotic and life cycle of a cell? What phases does mitosis consist of? What processes occur in each phase?

TEST YOURSELF:

CHOOSE ONE CORRECT ANSWER
1. As the formation of new mitochondria?
a. At the confluence of old mitochondria.
b. in the granular cytoplasmic network.
c. Division.
d. in the Golgi complex.

2. Where in the cell are proteins synthesized for export?
a. in the smooth cytoplasmic network.
b. Free ribosomes.
c. in the core.
d. in the granular cytoplasmic network.
f.In the mitochondria.

3. What functions do lysosomes perform in a cell?
a. protein Biosynthesis.
b. Participation in phagocytosis.
c Oxidative phosphorylation.
d. Intracellular digestion.

4. Digestive vacuole in an animal cell is called:
a. Pinocytosis vesicle
b. The lysosome
c. Phagosome
d. Fused phagosome with lysosome
f. Residual body

SELECT THE CONDITION UNDER WHICH THIS STATEMENT IS TRUE
5. Structural components of the cytoplasm:
a. Organelles.
b. Inclusions.
c. Nucleoli.
d. Hyaloplasm.
f. Cytolemma.
e. Karyolemma.

6. Cilia contain:
a. Two Central microtubules.
b. Nine pairs of peripheral microtubules.
c. Plasmolemma.
d. Basal body.
f. the Mitochondria.

7.Which of the listed organelles have a non-membrane structure?
a. Cell center.
b. Mitochondria.
c. the Golgi Complex.
d. Ribosomes.
f. the Cytoskeleton.

8.Organelles participate in the formation of lysosome enzymes and their membranes:
a. Granular EPS
b. Smooth EPS
c. the Golgi Complex
d. Lysosomes

9.The cell cytoskeleton is represented by:
a. actin filaments
b. microtubules
c. intermediate filaments
d. the system of intracellular membranes

10.The number of autophagosomes in the cell increases when:
a. cell damage
b. mitosis
c. metabolic stress
d.the city of endomitosis

MODULE ON THE CYTOLOGY OF THE
Targets.
1. Show knowledge of theoretical material on the studied topics.
2. Be able to determine and differentiate histological structures of tissues in micro-preparations.
3. Solve situational problems and tests.

Control question :
1. Give the definition of the cell. What elements are the tissues of animal organisms made of?
2. The main provisions of the cell theory.
3. List the forms of cells and their nuclei in relation to the function performed.
4. What is the cell surface? Describe the molecular structure of the biological membrane. Functions of the cell membrane.
5. Types of cellular contacts.
6. Name and describe non-cellular structures.
7. What is cytoplasm? Hyaloplasm, chemical composition, functions.
8. What are organelles? Classification of organelles.
9. Cell membrane organelles, structure, functions.
10. Non-membrane cell organelles, structure, functions.
11. What are inclusions? Types, structure, and functions.
12. List the structural components of the interphase core. Their structure and functions.
13. What is hetero - and euchromatin?
14. Describe the main stages of protein synthesis.
15. Name the structural components of chromosomes. What is a gene, chromosome set, and sex chromatin?
16. What is the cell cycle? What are the differences between the mitotic and life cycle of a cell?
17. What phases does mitosis consist of? What processes occur in each phase?

Micropreparations.
1. Cubic and prismatic tubules of the kidney (color hematoxylin-eosin).
2. Fusiform smooth muscle cell (hematoxylin-eosin color).
3. Process nerve cell of the spinal cord (silver nitric acid staining)
4.Loose fibrous connective tissue (stained with iron hematoxylin)
5.The symplast in the product language (staining with iron hematoxylin)
6.Mesenchyme of the embryo (staining with iron hematoxylin)
7.Golgi apparatus in the preparation spinal node (color with silver nitric acid)
8. Chondriosomes in the preparation of kidney tubules (color hematoxylin-eosin)
9.The inclusion of fat in the liver cells (staining with Carmine)
10.Inclusion of glycogen in the liver cell (best color)

11. Human blood smear (giemza-Romanovsky staining method)

TOPIC: EPITHELIUM. GLANDS.
PC-9

I. Motivational characteristics of the topic.
Epithelial tissues are widely represented in the body. They cover the body, line the surface of hollow organs, and are part of many internal organs. In a number of diseases, the structure and function of these tissues can undergo significant changes. For example, with the development of some tumors, the normal processes of differentiation of epithelial cells are disrupted, resulting in pathological tissue growth.
Knowledge of the characteristic morphological features of epithelial tissues in normal conditions helps to understand the essence of many pathological processes, correctly diagnose and predict the outcome of the disease.

II. Targets.
1. To understand the main morphofunctional and histogenetic features of epithelial tissues.
2. Be able to identify and identify epithelial tissue in preparations.
3. Study the structure of exocrine glands.
4. Be able to explain the mechanisms of the secretory process in glandular epithelial cells.

III. The required initial level.
1. Morphofunctional characteristics of organelles involved in the process of biosynthesis of substances and secretion
2. Plasmolemma and its derivatives
3. Structure of intercellular contacts
4. Cell cycle
5. Embryonic sources of epithelial tissue development.
From the current session
1. Morphofunctional and histogenetic features of epithelial tissues.
2. Classification of epithelium
3. Structure of various types of epithelium
4. The concept of the secretory cycle.
5. Structure and classification of exocrine glands.

IV.Object of study.
a) micro-products
1. Mesothelium of the omentum (painted with silver nitric acid)
2. Single layer cuboidal epithelium of tubules of kidneys (coloration of Gema-doxylin-eosin)
3. Trachea (hematoxylin-eosin stain)
4. Cornea of the eye (color hematoxylin-eosin)
5. Finger skin (hematoxylin-eosin stain)
6. Bladder (hematoxylin-eosin stain)

V. Information part.
Epithelial tissues cover the surface of the body, line the internal organs, are part of the serous membranes, and also forms most of the glands. There are: integumentary and glandular epithelium.
The epithelium is characterized by:
a. layers of epithelial cells
b. there is no intercellular substance between cells
c. cells are connected by various cellular contacts
d. cells lie on the basal membrane
f. epithelial cells do not contain blood vessels, nutrition is carried out diffusely through the basement membrane at the expense of the underlying connective tissue
e. epithelial cells are rich in receptor nerve endings

epithelial cells have a polarity.
According to morphological classification, single-layer epithelium (single-row and multi-row) and multi-layer epithelium are distinguished. In single-layer epithelial cells, all cells are connected to the basement membrane, in multi – layer-only one lower layer is directly connected to the basement membrane, and the other layers are devoid of such a connection and are connected to each other. According to the shape of the cells that make up the epithelium, they are divided into flat, cubic, prismatic. In this case, the multilayer epithelium takes into account only the shape of the outer layers of cells.

The ontophylogenetic classification, created by the Soviet histologist N. G. Khlopin, is based on the peculiarities of the development of epithelium from tissue rudiments. It includes the epidermal (skin), enterogermina (intestinal), telenephrology, efendioglu lny and angiotensinii types of epithelium.
The glandular epithelium consists of glandular or secretory cells granulozitov. They carry out synthesis, as well as the release of specific products –secretions on the surface of the skin, mucous membranes and in the cavity of internal organs (external - exocrine secretion) or in the blood and lymph (internal - endocrine secretion). Secretion is a complex process involving 4 phases: absorption of the initial products by glandulocytes, synthesis and accumulation of secret in them, secretion from glandulocytes and restoration of their structure.
Exocrine glands produce secrets that are released into the external environment. Each gland consists of a terminal (secretory) Department and an excretory duct.
Exocrine glands in the form of the terminal Department are: alveolar, tubular, alveolar-tubular.
• According to the structure of the output duct: simple and complex, branched and unbranched.
• By the nature of the secreted secretions: mucous, protein (serous), mixed, greasy.
• By type of secretion: merocrine, apocrine, holocrine.

VI.Learning activity.

1.Find and draw flattened cells (1) with jagged edges(2) and one or two rounded nuclei (3) in the center of the cells on the microparticle "mesothelium of the omentum".

2.On the micro-preparation "single-Layer cubic epithelium of kidney tubules" find and draw a cross section of tubules (1), the wall of which is lined with cubic cells (2), in the cytoplasm of which (3) round nuclei are visible (4).

3.On the micro-preparation "Trachea" find and draw a multi-row scintillating epithelium (1) on the inner surface of the organ. Determine: the basal membrane (2); scintillating cells (3) with cilia (4), the nuclei (5) of these cells are in the highest row. Below are the core low-intercalated cells (6), the average position of the nucleus (7) high-intercalated cells (8). Between the scintillating cells are goblet-shaped cells (9).

4.On micropreparative "Cornea" find and sketch stratified squamous neorogovevayuschy epithelium on the basement membrane (1) which is the basal layer of cylindrical cells (2) above is a layer sipomatic cells (3), then the surface layer of flat cells (4).

5.On micropreparative "Leather thumb" find and sketch stratified squamous keratinizing epithelium where the basal membrane lies the basal layer (1) layer of cylindrical cells; over it layer sipomatic cells (2); then the granular layer (3), a brilliant layer (4); stratum corneum (5).

6.On the micro-product "bladder" find and draw a transitional epithelium, on the basement membrane of which lies the basal layer (1), above it - a layer of integumentary cells (2).

7. Draw and mark drawings:

VII.Control question.
1.General characteristics of epithelial tissue.
2.Classification of the epithelium.
3.Single-layer epithelium, types, localization, structural features.
4.Multilayer epithelium, types, localization, structural features.
5.Glands, structure, classification, function. Secretory cycle of the glandular cell.

VIII.Learning objective.

1.In the experiment, the permeability of the basement membrane of the multilayer flat keratinized epithelium significantly decreased. How will this affect his life?
2.On the preparation, the secretory cells are cylindrical in shape, their tops protrude into the lumen. Some of them are destroyed. Secretory granules are defined in the cell tops. What type of secretion?
3.On the drug, the secretory Department of the gland. It was found that as we move away from the basement membrane, cells gradually accumulate secretions, pyknosis, and loss of nuclei. Cell disruption. What is the type of secretion?
4.Two drugs are presented. On the first preparation, iron with tubular end sections and unbranched exit ducts; on the second, iron with alveolar end sections and branched exit ducts. Which of the glands is simple, which is complex?

IX.The topics of structural abstracts.
1. N. G. Khlopin and his contribution to the study of epithelial tissue histogenesis.
2. Structural and biochemical bases of the process of keratinization.
3. Regeneration of epithelial tissues.
4. Mechanism of the secretory process.
5. Histogenetic features of the epithelium of the head intestine.

INDEPENDENT WORK

I.THE STUDENT SHOULD KNOW:

1.Features of the structure of epithelial tissue. 2.Differences between single-layer epithelium and multi-layer. 3.The differences of the epithelium from pseudostratified multilayered epithelium. 4.Glandular epithelium.	1.Histology under the editorship of YUI. Afanasiev, N. A. Yurinsky. - Moscow, 2006. 2. Methodological guide for students in histology. Part 1. L. A. Akoeva, L. A. gireeva, L. S. Tabolova, and others. Vladikavkaz, 2008. 3.Cytology. L. A. Akoeva.,L, A, gireeva, L. S. Tabolova et al. Vladikavkaz, 2004.

II.THE STUDENT MUST BE ABLE TO:
1. Recognize different types of epithelium at the microscopic level, distinguish single-layer epithelium from multi-layer, multi-layer epithelium from multi-row.
2. Determine the type of glands, the method of secretion at the microscopic level.

III. Tasks to prepare for the lesson:
Task 1.Fill in the tabl types of epithelium»:

The type of epithelium	The Localization of the epithelium	Function epithelium

Task 2.Fill in the "Glands" table»

Glands				
Parts of glands	Simple	Complex	Branched	Unbranched- feudal
The excretory duct branches				
The outflow duct does not branch				
One end section opens into the duct				

Task 3. Fill in the missing information.
The difference between exocrine and endocrine glands is.....
.....

Task 4.Make 2-3 test tasks based on the sample.
Basal membrane:
1.contains 4 types of collagen
2.it is formed by the epithelium
3.serves to attach the epithelium to the underlying tissues
4.it is a barrier to blood vessels and nerve fibers

IV. Questions for self-monitoring:
1. The concept and functions of the epithelium. Classification of the epithelium.
2. Structural features of the structure of epithelial tissues.
3. Single-layer and multi-layer epithelium, types, structural features, localization.
4. Describe the phases of the secretory cycle of glandular cells.
5. Differences between endocrine and exocrine glands.

TEST YOURSELF:
CHOOSE ONE CORRECT ANSWER
1. Which epithelium is called transitional?
a. Turning from single-layer to multi-layer.
b. Turning from flat to prismatic.
c. Turning from non-corneal to corneal.
d. Turning from non-ferrous to ferruginous.
f. Changing the arrangement of cell layers during stretching and compression.

2. How can you morphologically describe the mesothelium?
a. single-Layer prismatic epithelium.
b. A single layer of pseudostratified epithelium.
c. single-Layer flat epithelium.
d. multi-Layered epithelium.

3. Which exocrine glands are called complex?
a. Multicellular.
b. With branched end sections.
c.. With alveolar-tubular end sections.
d. With tubular terminal sections.
f. with a branched outflow duct.

4. What type of secretion is called merocrine?
a. The secret stands out without destroying granulozitov.
b. The secret stands with the complete destruction of granulozitov.
c. The Secret stands out with destruction of microvilli of granulozitov.
d.Secret is with the destruction of the tops of granulozitov.

5. What type of secretion is called holocrine?
a. The secret stands out without destroying granulozitov.
b. The secret stands with the complete destruction of granulozitov.
c. the Secret stands out with destruction of microvilli of granulozitov.
d.Secret is with the destruction of the tops of granulozitov.

6. What layers of cells divide in the multi-layer keratinizing epithelium:
a. Grainy.
b. Spiky.
c. Brilliant.
d. Basal.
f. Rogovogo.

SELECT THE CONDITION UNDER WHICH THIS STATEMENT IS TRUE
7. What listed histomorphological features are characteristic of epithelial tissues?
a. The edge position.
b. The layer of cells.
c. polar differentiation.
d. the presence of contractile structures.
f. Lack of emocapella.
e. Contain a large amount of intercellular substance.

8. What epithelium is included in the group of multilayered, according to the morphofunctional classification?
a. single Row.
b. Keratinizing.
c. multi-Row.
d. Transitional.
f. Neorogovevayuschy.

9. Which cells are part of the multi-row ciliated epithelium of the respiratory tract?
a. Ciliated.
b. goblet-Shaped.
c. Spiky.
d. Short inserts.
f. Flat.

10. Which of these signs are characteristic of the endocrine glands?
a. their secret is released into the blood.
b. their secret is delivered to the surface of the skin epithelium.
c. there Is an outlet duct
d. Excretory duct is missing.
f. their secret is delivered to the internal environment of the body.

TOPIC:BLOOD. LYMPH.
PC-9

I. Motivational characteristics of the topic.
In medical practice, blood tests play an important role. In clinical tests examine blood chemistry, determine the number of erythrocytes, leukocytes, hemoglobin, erythrocyte sedimentation rate. In a healthy person, the shaped

elements of blood are in certain quantitative ratios, which vary in different age groups. Changes in quantitative ratios, the appearance of shaped elements at different stages of development, indicates a pathological state of the body.

II.Targets.

1. Study the current understanding of the blood system.
2. Learn the differences in the hemato-and leukogram, know the leukocyte formula.
3. To understand the current understanding of the participation of T and B lymphocytes in the immune response of the body.
4. Learn to identify shaped elements in a blood smear.

III.The required initial level of knowledge.

a) from the previous topics

1. The structure of the cell, a variety of shapes of the nuclei.
2. Color of cellular structures

b) from the current session

1. Morphofunctional characteristics of blood
2. Representation of the hemogram
3. Representation of the leukocyte formula.

IV.Object of study.

a) micro-products

1. Smear of human blood (staining according to the method Romanovsky)
2. Frog blood smear (Romanovsky staining)

b) electronic messages.

No. 79,80,81,82,85,86,87,89,101.

V. Information part.

Blood - the internal environment of the body, consisting of cells (shaped elements) and intercellular substance (blood plasma).

Shaped blood elements occupy a volume of 40-45%. Among the shaped elements are: red blood cells, white blood cells, platelets.

Red blood cells are nuclear-free, biconvex cells that have lost the nucleus and most of the organelles during ontogenesis. The number of red blood cells in an adult male is from 3.9 •1012 to 5.5• 10 12V1 l, and in women - from 3.7• 1012 to 4.9 •1012 in 1 l. the Main function of red blood cells is to transport oxygen and carbon dioxide, i.e. to ensure respiratory function. This function is provided by hemoglobin (a complex protein that has iron in its composition). Red blood cells contain about 60% water and 33% hemoglobin. In humans, there are two types of hemoglobin-Hb A (typical for adults), Hb F (typical for embryos). Along with Mature red blood cells, normal blood contains 1-5% of young forms that are poor in hemoglobin. They are called reticulocytes. The lifespan of red blood cells is 120 days. With aging of red blood cells, there is a decrease in the activity of enzymes, there is a violation of gas exchange function due to a decrease in the ability to restore methemoglobin to hemoglobin.

White blood cells are globular white blood cells. In an adult 3,8•10 9– 9,0•109 in 1 liter of blood. White blood cells are capable of active movement, while they can dramatically change the shape of the body and core. Blood flow carries white blood cells throughout the body, evicted in the tissues and organs, where they show the greatest activity. Certain types of white blood cells participate in the protective function, providing phagocytosis of microbes, foreign substances and cell breakdown products, as well as participate in the formation of cellular and humoral immunity.

White blood cells are: granulocytes (the cytoplasm contains granules of certain substances) and agranulocytes (the cytoplasm does not have granules). Granulocytes include: neutrophils, eosinophils, basophils, agranulocytes – lymphocytes and monocytes.

Neutrophils are round-shaped cells with a diameter of 7-9 microns. The number reaches 65-75% of the total number of white blood cells. The cytoplasm of the cell is weakly oxyphilic, it contains a small pink-purple grain. There are two main types of granules – azurophilic and neutrophilic. These granules contain hydrolytic and proteolytic enzymes. Mature neutrophils have segmented nuclei consisting of 3-5 lobes connected by thin bridges. These are segmentonuclear neutrophils, 60-65% of them. There are fewer rod-shaped neutrophils (3-5%), whose nuclei are shaped like sticks or horseshoes. Even less common are young neutrophils (0.5-1%) with bean-shaped nuclei. In the nuclei of most neutrophils in women, there are paronuclear appendages that contain a single X chromosome, so it is called sex chromatin. The main function of cells is phagocytosis. The life span of neutrophils is about 8 days, while they are in the bloodstream for 8-12 hours, and then – in the connective tissue, their maximum activity is manifested.

Eosinophils are large cells with a diameter of 9-10 microns. The number of them in the blood ranges from 1-5 % of the total number of white blood cells. The cytoplasm contains large oxyphilic granules containing acid phosphatase.

The core consists of two segments connected by a jumper. Eosinophils are capable of phagocytosis, take part in the body's protective reactions to foreign protein, in allergic and anaphylactic reactions. Eosinophils stay in the bloodstream for 3 to 8 hours, and then they migrate to the connective tissue, where they function.
Basophils have a diameter of 11-12 microns. In human blood, they make up 0.5-1% of the total number of white blood cells. The cell cytoplasm is filled with large basophilic granules containing histamine and heparin. The basophil nucleus is often weakly lobed. The function of basophils is to metabolize histamine and heparin. They take part in the regulation of blood clotting and vascular permeability, participate in allergic reactions.
Lymphocytes make up 20-35 %. Diameter from 4.5-10 microns. Morphologically, lymphocytes are divided into small light, small dark, medium, and plasma cells. According to the ways of differentiation and the role in the formation of protective reactions, two main types are identified-T and B lymphocytes. T-lymphocytes provide cellular immune responses and regulation of humoral immunity. In the population of T-lymphocytes, t-killer lymphocytes (which are effector cells of cellular immunity), T-helper cells, T-suppressors, T-suppressors (which have a regulating effect on B-lymphocytes), and t-memory cells were identified. B-lymphocytes provide humoral immunity.
Monocytes-slightly larger than other white blood cells (9-12 microns), in the blood their number is 6-8% of the total number of white blood cells. The nucleus is bean-shaped, the cytoplasm is basophilic. The residence time of monocytes in the blood varies from 1.5 to 3 days. Monocytes belong to the macrophage system. Monocytes, which are evicted in the tissue, turn into macrophages, while they have a large number of phagolysosomes.

Platelets are tiny colorless bodies, round, oval, fusiform in shape. They are separated nuclear-free fragments of the cytoplasm of megakaryocyte cells, 2-3 microns in size. Their number in 1l of blood ranges from 200 * 109 to 300•109. Each plate consists of hyalomere, which is the basis of the plate and granulomere - grains forming a cluster in the center of the plate or scattered on hyalomere. When staining using the Romanovsky-gimz method, 5 types of blood plates are distinguished: young, Mature, old, degenerative, and giant. Platelets take part in the blood clotting process. The lifespan of blood plates is 5-8 days.

A hemogram is a quantitative ratio of the blood's shaped elements.

The white blood cell formula is the percentage of white blood cells.

VI. Learning activity.
1.On the micro-drug "human blood Smear" to find at high magnification a large number of red blood cells (1)- non-nuclear cells of red color. In the field of vision can detect large cells with segmented nucleus (3-4 segments), the cytoplasm which contains fine dust-like grit red color - neutrophils (2): less common lymphocytes (3) - small cells, nucleus occupies a large part, intensely colored basic dyes, the cytoplasm in the form of a narrow rim at the periphery.
Significantly less common are the other shaped elements of blood:
eosinophils (4) - large cells, the nucleus is segmented (2 segments connected by a bridge), red large granularity; basophils (5) – large cells, the nucleus is S-shaped, poorly segmented, in the cytoplasm small and large basophilic granularity; monocytes (6) - the largest blood cells with a bean - shaped nucleus, basophilic cytoplasm; platelets (7) - basophilic bodies with granularity in the center.
Use the audience tables to draw shaped elements of blood.
2.Consider and compare the drug "frog blood Smear" and "human blood Smear".
3. Fill in the table.

Formed element -.	Cell pattern	The source of development, location of development	Main function	quantity or % content	Characteristic structural features defined by the function

VII.Control question.
1.General characteristics of blood and lymph as tissues (development, structure, function, ability to regenerate).
2.Classification of formed elements of blood.
3.The concept of the hemogram and leucocytic formula.
4.Morphological characteristics of shaped blood elements.
5.Modern understanding of the mononuclear phagocyte system and the participation of T and B lymphocytes in cellular and humoral immunity.

VIII.Learning objective.
1.As a result of the transformation, a population of cancer cells appeared in the body. What blood cells will detect and start attacking cells that have deviated from normal development? What is the name of this phenomenon?
2.The child was diagnosed with a worm infestation. What changes in the leukocyte formula should be expected?
3.When the skin was damaged, there was a longer-than-normal bleeding of the wound surface. The lack of what shaped blood elements can cause the lengthening of bleeding time? Which enzyme of these shaped elements takes part in the blood clotting process?
4.The first half of pregnancy in some women is complicated by toxicosis, which develops in response to the entry of fetal metabolites into the woman's blood. Which blood cells will react to these toxic products? How will the content of these cells in the blood change and why?
5.People with low culture often make tattoos-subcutaneously inject paint that is not destroyed in the body. Therefore, the pattern on a person's skin is preserved for life. What blood cells, leaving the vessels, absorb this paint? What is the name of the tissue form of existence of these cells? What is the name of the dye absorption process?
6.In judicial practice, traces of the criminal's blood were found at the crime scene. The forensic examination concluded that the crime was committed by a woman. The cells were subjected to analysis? What morphological feature in these cells allowed us to identify the sex of the criminal?
7.In most people, red blood cells contain an antigen called RH factor. Some people do not have this antigen, so their blood is RH-negative. If a person with RH-negative blood is inadvertently transfused from a RH-positive donor, their red blood cells will undergo hemolysis in the recipient's body. What kind of immune defense cells of the recipient will be activated with such a blood transfusion? In what cell population do they transform under the influence of RH-antigen? Which product of the newly formed population will play a major role in the reaction of red blood cell hemolysis?
8.The patient was mistakenly injected with a hypotonic solution. What changes can occur with red blood cells?
9.It is known that the plasma cell produces specific antibodies to this antigen. When the antigen is administered, the number of plasma cells increases. Due to what blood cells there is an increase in the number of plasma cells?
10.If a person's blood is taken for analysis soon after performing heavy physical work, the hemogram will differ from the normal one. The number of shaped elements in this regard will change in the blood and how?
IX.The topics of structural abstracts.
1. Hematopoietic stem cells
2. Iron metabolism and erythropoiesis.
3. Platelet histophysiology.
4. Differentiation of megakaryocytes.
5. Accumulation of methemoglobin and age of red blood cells.

INDEPENDENT WORK

I THE STUDENT SHOULD KNOW:

1.General characteristics of blood and lymph as tissues 2.Classification of formed elements of blood. The concept of hemogram and leukocyte formula, their significance in the clinic 3.Morphological characteristics and functional significance of red blood cells, white blood cells and platelets 4.Modern understanding of the mononuclear phagocyte system and the participation of T-and B-lymphocytes in cellular and humoral immunity 5.Morphofunctional characteristic of lymph	1.Histology edited by Yu. I. Afanasiev, N. A. Yurina. - Moscow, 2006. 2. Histology: textbook / Under the editorship of E. G. Ulumbekova, J. A. Chelysheva. - 2nd ed., pererab. and add. - M.: GEOTAR-MED, 2009 3. Methodological guide for students in histology. Part 1. L. A. Akoeva, L. A. gireeva, L. S. Tabolova, and others. Vladikavkaz, 2008. 4.Age and histology. Blood. The organs of hematopoiesis. Circulatory organs. Methodological guide for students of medical, pediatric, preventive medicine and dental faculties. L. A Akoeva., L,A, Gireiev, L. S. Tabolov. Vladikavkaz, 2011.

II. THE STUDENT SHOULD be ABLE to: microscopy of human blood smears, colored by the Romanovsky-Gimza method, to find shaped elements: red blood cells, neutrophils, basophils, eosinophils, lymphocytes, monocytes, platelets.

III. Tasks to prepare for the lesson:

Task 1. Fill in the table:

Indicator		Normal values
Erythrocytes	in men	
	in women	
Leukocytes:		
Granulocytes	neutrophils	
	eosinophils	
	basophils	
Agranulocytes	lymphocytes	
	monocytes	
Platelets		

Task 2. Add the missing information in the text below:

The main function of neutrophils - ..... It is carried out in several stages. After preliminary specific recognition of foreign material, the neutrophil membrane invagination occurs around the particle and the formation of.....……..... Then, as a result of the fusion of the phagosome with the lysosomes, it is formed .....….. , after which happens.....…..... To do this, the phagolysosome receives: .....……..... .

Task 3. Specify what changes will occur with red blood cells after placing them in the appropriate solutions:

hypertonic solutionë **isotonic solution** **hypotonic solution**

Task 4. Add the missing information in the scheme "classification of lymphocytes»

lymphocytes:

by size **by function** **by life span**

Task 5. Make up three test tasks on the topic under study using the following sample:
The function of phagocytosis is characteristic of the following types of cells:
1. neutrophils
2. lymphocytes
3. eosinophils
4. monocytes
5. basophils

IV. Questions for self-monitoring
1. Classification of shaped elements.
2. Morphofunctional characteristics of red blood cells.
3. White blood cells: General characteristics and classification. Concept of the leukocyte formula.
4. Morphological and functional characteristics of granulocytes. The composition of specific granules.
5. Morphological and functional characteristics of lymphocytes. Participation of T-and B-lymphocytes in cellular and humoral immunity.
6. Morphological and functional characteristic of monocytes. The concept of the mononuclear phagocytic system.
7. Platelets: the main structural components and functional significance. The composition of granules of the platelets.
8. Morphofunctional characteristic of the lymph.

TEST YOURSELF:
1. What is the source of embryonic blood development?
a. Ectoderm.
b. intermediate mesoderm.
c.. Mesenchyma.
d. extra-Germ endoderm.
f. Ventral mesoderm.

2. What volume part of blood is plasma?
a. 40-45%.
b. 45-50%.
c. 55-60%.
d. 60-65%.
f. 65-70%.

3. What is the average number of red blood cells in women?
a. 3,7-4, 9h1012/l.
b. 2,8-3, 5x1012/l.
c.. 3,9-5,5x1012/l.
f. 4.5-6x1012/l.

4. Name the white blood cells responsible for histamine synthesis.
a. Basophilic leukocytosis.
b. Neutrophilic leukocytosis.
c. Lymphocyte.
d. Eosinophilic leukocyte.
f. the Monocyte.

5. Which cell has the function of immunoglobulin synthesis?
a. red blood Cell.
b. The monocyte.
c. Basophilic leukocytosis.
d. Plasmocyte.
f. Eosinophilic leukocyte.
e. Neutrophilic leukocytosis.

6. What is the main function of neutrophils?
a. Formation of antibodies.

b. phagocytosis of microorganisms and small particles.
c. Phagocytosis of the antigen-antibody complex.
d. Inactivation of histamine. Participation in allergic and anaphylactic reactions

7. What is the percentage of lymphocytes from the total number of white blood cells?
a. 65-75%.
b. 1-5%.
c. 0.5-1%.
d. 2-8%.
f. 18-38%.

8. What is the average total number of platelets in a healthy adult?
a. 6,0-8, 0x109/l.
b. 10.0-30, 0x109/l.
c. 4,0-9,0x109/l.
d. 3,9-5, 5x1012/l.
f. 200-300x109/l.

9. What is contained in the red blood cell of a healthy person?
a. Heparin.
b. Serotonin.
c. Myoglobin.
d. Hemoglobin.
f. Carboxyhemoglobin.

10. The composition of hemoglobin in adult red blood cells?
a. Hb A-98%.
b. Hb F-70%.
c. HbA-30%.
d. Hb F - 2%.

TOPIC: CONNECTIVE TISSUE PROPER.
PC-9

I. Motivational characteristics of the topic.
Knowledge of the structure and functions of various types of connective tissue that make up most of the organs that form the stroma and accompany blood vessels is necessary for understanding the basic processes of a healthy body, since connective tissue is actively involved in metabolic processes, in maintaining homeostasis and organ architectonics.
II.Targets.
1. To study the morphological features and the ability to regenerate a group of connective tissues proper.
2. Learn to recognize and characterize different types of connective tissue.
3. To understand the significance of the reactive properties of connective tissue and the mononuclear system of phagocytes for the body.
4. Explain the participation of connective tissue in creating the internal environment of the body and performing the main functions-trophic, mechanical, protective, plastic.

III.The required initial level of knowledge.
a) from the previous topics
1. The ratio of cells and intercellular substance in tissues.
2. Physical and chemical state of the intercellular substance.
3. Cell structure.

b) from the current topic
1. Morphofunctional characteristics of connective tissue.
2. Classification of connective tissue.
3. Structure and localization of various types of connective tissue.
IV.Object of study.

a) micro-products

1. Tendon (hematoxylin-eosin stain)

2. Finger skin (hematoxylin-eosin stain)

3. Human omentum (painted with Sudan III)
4. Lymph node (hematoxylin-eosin stain)

V. Information part.

Connective tissues are characterized by a variety of cells and a well-developed intercellular substance consisting of fibers and the main amorphous substance. Physico-chemical characteristics of the intercellular substance and its structure is to a large extent determine the functional significance of the varieties of connective tissue. Connective tissues themselves are divided into fibrous connective tissues and tissues with special properties. Fibrous connective tissues are divided into loose unformed and dense formed and unformed connective tissues.

Loose connective tissue is found in all the organs and forming the stroma, and accompanied by blood and lymph vessels. In its composition, it has cells and intercellular substance.

The cells of the connective tissue are diverse. Among them are fibroblasts, macrophages, plasmocytes, mast cells, adipocytes, pigmentocytes, adventitial cells, as well as leukocytes that migrated here from the blood.

The intercellular substance of connective tissue consists of collagen, elastic, reticular fibers, as well as the main substance. Collagen fibers are strong, poorly stretchable, and contain the fibrillar protein collagen, which is synthesized on the EPS of fibroblasts. Reticular fibers belong to the type of collagen, because they include the protein collagen and an increased amount of carbohydrates. Elastic fibers are well stretchable, fragile to break. It contains the fibrillar protein elastin. The main substance is a gelatinous hydrophilic medium consisting of water, sulfated glycosaminoglycans of chondroitinseric acid, proteoglycans, hyaluronic acid, and minerals. The physical and chemical state of the intercellular substance largely determines the functional features of connective tissue.

Loose fibrous connective tissue is characterized by a small number of randomly arranged fibers, with a predominance of the main substance and cellular components. Dense fibrous connective tissue is characterized by a relatively large number of densely arranged fibers and a small number of cellular elements and the main amorphous substance between them. Dense unformed connective tissue is characterized by an unordered arrangement of fibers. It forms capsules, epiglottis, periosteum, reticular layer of the dermis of the skin. In a dense connective tissue, the fibers are arranged in a strictly ordered manner. It occurs in tendons, ligaments, membranes, and fascia.

To the connective tissues with special properties include reticular, adipose, skin and mucous membranes. These tissues are characterized by a predominance of homogeneous cells.

VI.Learning activity.

1.On the micro-product "Tendon" find and draw at high magnification collagen bundles of the first order (1), between which tendon cells (fibrocytes) - (2) lie; they are combined into larger collagen bundles of the second order (3), between which layers of connective tissue with single fat cells (endotenon)- (4).

2.On the micro-product "finger Skin" find and draw clusters of fat-free fat cells(1), the cytoplasm (2) of which is located on the periphery of the cell in the form of a narrow rim; the nucleus (3) is pushed to the periphery; divided by a thin layer of connective tissue (4) into segments. In the same preparation, find and consider dense unformed connective tissue.

3.On the micro-product "human omentum" find and draw Sudan-colored clusters of fat cells (1), in the cytoplasm of which well-preserved drops of fat secret (2).

4.On the microparameter "Lymph node" find at high magnification and draw the cells of the stellate form (1), the nuclei of which are rounded with a moderate amount of chromatin lumps. Cells, connecting with each other, form syncytium. Individual syncytial cells separate from the General network and become free macrophages (2). Reticulin fibers (3) and an amorphous adhesive substance (4) are visible between the cells.

5. Draw and mark drawings:

VII.Control question.

1.Classification of the groups of connective tissues. Contribution of Russian scientists to the development of the doctrine of tissues (A. A. Maksimov, A. A. Zavarzin, V. G. Eliseev).

2.Sources of development, structure, functional significance and localization of certain types of fibrous connective tissue.

3.Cellular composition of connective tissues, morphological and functional characteristics of cells.

4.Intercellular substance of connective tissues, morphological and histochemical characteristics. Participation of fibroblasts and mast cells in the formation of intercellular substance.

5.Features of the structure of connective tissues with special properties.

VIII.Learning objective.

1.At the site of introduction of a foreign body in the body, inflammation occurs with the participation of blood cells and loose fibrous connective tissue. What blood and connective tissue cells will be found in the focus of inflammation?
2.In human avitaminosis in fibroblasts of loose fibrous connective tissue, the synthesis of tropocollagen protein is disrupted. What changes will be observed in the intercellular substance?
3.A live vaccine has been introduced into the human body. Which cells of loose fibrous connective tissue are involved in the production of specific immunity?
4.Clinical Ehlers-Danlos syndrome is accompanied by loss of connective tissue strength (joint sprain, skin fragility, and blood vessel fragility). What fibers are affected in this to a greater extent?
5.A bee or snake bite is accompanied by rapid penetration of the poison into the body. What is the reason for this?
IX.The topics of structural abstracts.
1. The concept of the macrophage or reticuloendothelial system (RES). The value of the works of Mechnikov.
2. Physiological and reparative regeneration of connective tissue.
3. Development, structure and function of connective tissue. Structure of tendons, ligaments, and fibrous membranes.

INDEPENDENT WORK

I.THE STUDENT SHOULD KNOW:

1. General characteristics of the connective tissue group 2. Classification of connective tissues. Cellular composition of connective tissues, morphological and functional characteristics of cells 3. Intercellular substance of connective tissues, morphological and histochemical characteristics 4. Structure, functional significance and localization	1.Histology: textbook / edited by Yu. I. Afanasiev, N. A. Yurina. - 5th ed., pererab. and add. - M.: Medicine, 2006. 2.Histology: textbook / Under the editorship of E. G. Ulumbekova, J. A. Chelysheva. - 2nd ed., pererab. and add. - M.: GEOTAR-MED, 2009.

II.THE STUDENT MUST BE ABLE TO:

Determine at the microscopic level the main structural components of fibrous connective tissues and tissues with special properties

III. Tasks to prepare for the lesson:
Task 1. Fill in the table: «types of connective tissue fibers»
Collagen Elastic Reticular

	Collagen	Elastic	Reticular
Preemptive localization			
Diameter			
Main structural components			
Availability cross striations			
Degree extensibilities			
Degree strengths			

Task 2. Fill in the table « Fabrics with special properties»:

	Localization	Cellular structure	Features of intercellular substance	Functions
Reticular				
Mucous				
Pigment				

Task 3. Fill in the table « Comparative characteristics of adipose tissue types»:

	White adipose tissue	Brown adipose tissue
Localization		
The location of the kernel		

Number and location of fat drops		
Number of mitochondria		
Functions		

Task 4. Make 2-3 test tasks based on the sample.
The tendon contains:
a. myofibroblasts
b. parallel bundles of elastic fibers
c. fibrocytes
d. layers of dense fibrous connective tissue
f. a small amount of the main amorphous substance

IV. Questions for self-monitoring:
1. Classification of connective tissues.
2. Features of the microscopic structure of loose fibrous connective tissue. The main differene cells.
3. Structure and functions of the main types of fibroblasts.
4. Features of micro-and ultrastructure of macrophages.
5. Morphofunctional characteristics of mast cells.
6. Features of the structure of plasmocytes. Role in the processes of immunogenesis.
7. Microscopic structure and chemical composition of connective tissue fibers.
8. Composition of amorphous substance of connective tissue.
9. Features of the microscopic structure of dense fibrous connective tissue.
10. Structure of connective tissues with special properties.

TEST YOURSELF:
1. Specify the main signs of loose fibrous connective tissue:
a. Diversity of cells, predominance of the main substance, disordered fibers.
b. Monotony of cells, the predominance of ordered fibers.
c. Monotony of cells, predominance of the main substance, orderliness of fibers.
d. Diversity of cells, the predominance of disordered fibers.

2. What are the General morphofunctional features of the connective tissues themselves:
a. Cells form a layer.
b. Develop from mesenchyma.
c. Develop from the endoderm.
d. a Large amount of intercellular substance.
f. Contain fibers.

3.Specify the main signs of dense connective tissue:
a. Predominance of the main substance.
b. The monotony of the cells.
c. the Predominance of the fibers.
d. Diversity of cells.

4. Specify the signs of collagen fibers:
a. Contain striated protofibrils.
b. Anastomose.
c. Do not anastomose.
d. Thick (1-10 mkm), form the bundles.
f. Have high elasticity.

5. The composition of any of the bodies includes decorated dense fibrous
connective tissue?
a. Skeletal muscles.
b. Leather.

c. Bundles.
d. the Tendon.
f. Fascia and the aponeurosis.
e. the blood-forming organs.

6. Part of any authority part of reticular tissue?
a. Tendons.
b. Organs of haemopoiesis and immunogenesis.
c. Skin.
d. Skeletal muscles.
f. Vessels.

7. Determine the features (signs) of the microscopic structure of plasma cells:
a. the cytoplasm contains metachromatic granules.
b. the Cytoplasm is intensely basophilic.
c. the Core is located eccentrically.
d. lumps of heterochromatin in the nucleus are arranged radially ("like spokes in a wheel").
f. the granular endoplasmic network is Well developed.
e. there are many lysosomes In the cytoplasm.

8. Loose fibrous connective tissue:
a. Accompanies blood vessels.
b. It forms the fascia and aponeurosis.
c. Located under the basement membrane of the epithelium, providing its nutrition.
d. Forms the stroma of many organs.

9. Brown adipose tissue.
a. Present in newborns.
b. Cell braided emocapella.
c. there are many mitochondria In the cytoplasm of cells.
d. the color of the tissue is determined by mitochondrial cytochromes.
f. the Cytoplasm is filled with one large drop of fat.

10. Select the cells that are most actively involved in phagocytosis:
a. Neutrophils.
b. Lymphocytes.
c. Macrophages.
d. Basophils.

TOPIC: SKELETAL TISSUE.
PC-9

I. Motivational characteristics of the topic.
Cartilage and bone tissue are the supporting tissues of the body that make up the skeleton. Cambial elements of cartilage and bone tissue are involved in the process of growth and regeneration of these tissues, which is of great importance in fractures. Various factors (external and internal) can influence the correct formation of the skeleton in embryogenesis and postnatal period.

II.Targets.
1. Show knowledge of the General features of the structure of skeletal connective tissues; as well as the structure of cartilage and bone as organs.
2. To understand the essence and histological characteristics of the processes of chondrogenesis and osteogenesis.

III.Required initial level of knowledge
a) from the previous topics
1. Cell structure
2. Composition of intercellular substance

b) from the current topic
1. Classification and source of skeletal tissue development.
2. Features of the structural organization of cartilage and bone tissues.

3. Methods of histogenesis of cartilage and bone tissue.

IV.Object of study.
a) micro-products
1. Hyaline cartilage (hematoxylin-eosin stain)
2. Elastic cartilage (paint gorseinon)
3. Fibrous cartilage (hematoxylin-eosin stain)
4. Lamellar bone tissue (dyed by the method of schmorl's)

V. Information part.
Skeletal tissues include cartilage and bone tissue. They consist of cells and intercellular substance. Cartilage cells-chondroblasts and chondrocytes. Chondroblasts –young, flattened cells capable of proliferation and the synthesis of the intercellular substance of the cartilage. Chondrocytes are the main type of cartilage tissue cells, round, oval, polygonal in shape. They are located in lacunae in the intercellular substance alone or in isogenic groups. There are three types of chondrocytes in isogenic groups. The intercellular substance contains 70-80% water, 10-15% organic substances (proteins, lipids, glycosaminoglycans, proteoglycans), and 4-7% inorganic substances. The cartilage tissue itself has no blood vessels, and nutrients diffuse from the surrounding cartilage. Cartilage tissue according to the structural and functional features of the structure of the intercellular substance is divided into: hyaline, elastic, fibrous.
Hyaline cartilage makes up most of the skeleton of a developing embryo. in an adult, it occurs at the junction of the ribs with the sternum, in the larynx, in the Airways, and on the articular surfaces of bones.
Elastic cartilage tissue forms the auricle, epiglottis, horn-shaped and wedge-shaped cartilages of the larynx.
Fibrous cartilage occurs in intervertebral discs, in semi-mobile joints, in places where fibrous connective tissue transitions into hyaline cartilage.
Bone tissue is a specialized type of connective tissue with high mineralization of intercellular substance. There are two types of bone tissue: reticulofibrous and lamellar. They differ in their structural and physical properties, which are due to the structure of the intercellular substance. Morphofunctional properties of bone tissue change depending on age, muscle activity, nutritional conditions, as well as under the influence of the activity of the endocrine glands.
Bone tissue contains three types of cells: osteoblasts, osteocytes, and osteoclasts. Osteoblasts-young cells that create bone tissue, are found in the deep layers of the periosteum and areas of bone regeneration. Osteocytes are the main cells of bone tissue that have lost the ability to divide and produce components of intercellular substance. They are located in lacunae filled with tissue fluid. Exchange between osteocytes and blood is carried out through tissue fluid. Osteoclasts are giant cells that can destroy calcified cartilage and bone. Intercellular substance contains 72% of mineral substances (carbonates, phosphates, calcium fluorides) and 28% of organic substances (proteins, glycosaminoglycans, proteoglycans).
There are two types of bone tissue - reticulofibrous and lamellar. They differ in their structural and physical properties, which are due to the structure of the intercellular substance. Reticulofibrosal (coarse-fibred) bone tissue is found in embryos, in adults - in the areas of overgrown sutures of the skull. It consists of randomly arranged rough bundles of collagen fibers, bone cells-osteocytes located in lacunae. Lamellar bone tissue consists of bone plates formed by bone cells and a mineralized amorphous substance with collagen fibers oriented in certain directions. In the diaphysis, there are three layers: the outer layer of common plates, the middle layer formed by concentrically stratified bone plates around the vessels-osteones and the inner layer of common plates. The osteon is a structural unit of the compact substance of the tubular bone.
The development of bone tissue is carried out both in embryogenesis (direct and indirect osteohistogenesis) and in the post-embryonic period (during regeneration and ectopic osteohistogenesis).

VI.Learning activity.

1.On the micro-product "Hyaline cartilage" find and draw a dense fibrous connective tissue of the supracondyle (1), in which blood vessels (b) and young cells - chondroblasts (C) are located among the collagen fibers (a). Under the epiglottis is the cartilage proper (2), consisting of cartilage cells - chondrocytes (3), located singly or in isogenic groups (4). Around the cells, there are basophilic (d) and acidophilic (d) zones. Between the cells lies the main amorphous substance (5).

2.On the "Elastic cartilage" micropreparation, find and draw the supra-cartilage (1), under which the cartilage itself is located (2), which shows isogenic groups of chondrocytes (3) or individual chondrocytes (4). Elastic fibers are clearly visible among the cells (5). The space between cells and fibers is filled with the main amorphous substance (6).

3.Consider the micro-product "Fibrous cartilage" and find structures characteristic of cartilage in it.

4.Find and draw the outer periosteum (periosteum) (A) on the micro-preparation "Lamellar bone tissue", which distinguishes the outer adventitial layer (1) and the inner fibrous layer (2), in which blood vessels (3) and young

cartilage cells-osteoblasts (4) are visible. Under the epiglottis is a bone (B) consisting of external General plates (5), the haversov system - osteons (6), insert plates (7) and internal General plates (8). In osteone (6), under high magnification, you can see the osteone channel (a), around which the bone plates (b) are concentrically layered. In the bone plates, you can see bone lacunae with Islands of osteocytes (d). Under the layer of internal General plates (8) is located the internal periosteum - endost (9).

5. Draw and mark drawings:

VII.Control question.
1.General characteristics of cartilage tissue. Classification and topography of cells and intercellular substance.
2.Cartilage as an organ. Structure of the epiglottis and its role in nutrition, growth and regeneration of cartilage.
3.Features of the structure and localization of various types of cartilage tissue.
4.General characteristics of bone tissue. Cells and intercellular substance.
5.Classification of bone tissue. Morphofunctional characteristics of various types of bone tissue.
6.Structure of the tubular bone as an organ. Histotopography of blood capillaries and cambial elements.
VIII.Learning objective.
1.In one of the mouse lines, the synthesis of chondroitin sulfate is disrupted. How does this disorder affect the development of cartilage tissue?
2.With aging, the water content in hyaline cartilage decreases . How will the elasticity of the cartilage change?
3.It is common for humans to walk upright, while orangutans hang from tree branches in a variety of poses. Does the direction of ossein fibers in the bodies of the human and orangutan vertebrae differ?
4.It is known that glucocorticoid hormones inhibit the functional activity of chondroblasts and osteoblasts. How will the administration of large doses of glucocorticoids to a pregnant female affect osteogenesis in the tubular bones of the embryo?
5.An animal with an experimental bone fracture was injected with the hormone calcitonin, which stimulates the function of osteoblasts. How will calcitonin affect the bone regeneration process?
6.The human tubular bone preparation lacks an epiphyseal growth plate. What is the probable age of a person?
7. The rats were in space flight conditions for a month. How will the content of calcium salts in the bone tissue change?
8. The rats were subjected to physical activity for a month (running in a special apparatus). How will the strength of the bone tissue of the extremities change?
IX.The topics of structural abstracts.
1. Physiological bone regeneration.
2. Formation of intercellular substance according to electron microscopy and autoradiography.
3. Cell renewal.
4. Life of bone tissue.

INDEPENDENT WORK
I.THE STUDENT SHOULD KNOW:

1. General characteristics and classification of cartilage tissues 2. Morphofunctional characteristics of the cells of cartilage 3. Features of the structure and localization of various types of cartilage tissue 4. General characteristics and classification of bone tissues 5. Morphofunctional characteristics of the bone tissue cells 6. Features of the structure and localization of various types of bone tissue 7. The structure of the perichondrium and periosteum and their role in the processes of nutrition, growth and regeneration 8. Structure of the tubular bone as an organ. The concept of gaversovyh systems.	1.Histology: textbook / edited by Yu. I. Afanasiev, N. A. Yurina. - 5th ed., pererab. and add. - M.: Medicine, 2006. 2.Histology: textbook / Under the editorship of E. G. Ulumbekova, J. A. Chelysheva. - 2nd ed., pererab. and add. - M.: GEOTAR-MED, 2009. 3. Methodological guide for students in histology. Part 1. L. A. Akoeva, L. A. gireeva, L. S. Tabolova, and others. Vladikavkaz, 2008.

II.THE STUDENT MUST BE ABLE TO:
Determine the main structural components of cartilage and bone tissues at the microscopic level

III.Tasks to prepare for the lesson.
Task 1. Fill in the table « Cartilage differon»:

Cell		Features of the structure	Function
The chondroblasts			
Chondrocytes	type I		
	type II		
	type III		

Task 2. Add the missing information in the text below:

Divided chondroblasts do not diverge, but form ……..... groups of cells consisting of .....chondrocytes'. Cells secrete ..... that have .....this reaction gives significant basophilia to the areas of intercellular substance surrounding the cell groups. These basophilic areas are called..... the matrix of cells. Areas far from these groups are characterized by weak basophilia and are called .....matrix.

Task 3. Fill in the table « Comparative characteristics of types of cartilage tissue»:

	Hyaline	Elastic	Fibrous

Localization			
Color			
Features of intercellular substance			
Basic physical properties			
The ability to deify			

Task 4. Fill in the table «types of bone tissue»:

Type of bone tissue	Localization	The presence of LPS	The arrangement of the collagen fibers'

Task 5. Make up three test tasks on the topic under study using the following sample:
The osteon consists of:
a. endost
b. osteocytes
c. side plates
d. insert plates
f. outside of the General records

IV. Questions for self-monitoring
1. Classification of skeletal tissues.
2. General characteristics of cartilage tissues. Cartilage differon.
3. Features of the structure of hyaline cartilage tissue.
4. Features of the structure of elastic cartilage tissue.
5. Features of the structure of fibrous cartilage tissue.
6. Bone tissue: General characteristics, features of structure and localization.
7. Structure of the tubular bone as an organ.
8. The structure of the perichondrium and periosteum and their role in the processes of nutrition, growth and regeneration.
9. The main stages of chondrogenesis and osteohistogenesis.

TEST YOURSELF:
1. Name the structures of the compact substance of the diaphysis:

a. Layer of the osteons.
b. External system of common plates.
b. the Internal system of General records.
d. Bone trabeculae.

2. Name the types of bone tissue:
a. Lamellar.
b. Spongy.
c. rough-fiber.
d. Compact.

3. The cells (symplast) destroy the bone tissue?
a. Osteocytes.
b. Osteoblasts.
c. Chondroclasts.
d. Osteoclasts.
f. Fibroblasts.

4. What is the name of the area surrounding the cartilage outside and what is its role?
a. Endost.
b. The periosteum.
c. Periander (perichondrium).
d. Nutrition of the cartilage.

5. The bone tissue is characterized by constant restructuring. What is it
what is it?
a. Only in the resorption of old osteons.
b. Only in the creation of new osteons.
c. in resorption of old and creation of new osteons.
d. in the disappearance of insert plates.
f. in increasing the thickness of the periosteum and endost.

6. What kind of cartilage never calcifies?
a. Hyaline.
b. Elastic.
c. Fibrous.

7. In the area of Mature cartilage, all of the above is present, EXCEPT:
a. Basic substance.
b. Chondrin fibers.
c. Blood vessels.
d. Isogenic groups of cells.

8. What bone tissue forms the cranial sutures?
a. Lamellar.
b. Compact.
c. rough-fiber.
d. Mature.

9. What is the inserted records?
a. Material for the formation of osteons.
b. Remnants of old osteons.
c. Part of the newly formed osteons.
d. Component of coarse-fiber bone tissue.

10. Specify the osteoclast precursor.
a. Osteoblast.
b. Chondroblast.
c. Macrophage.
d. Monocyte, adventitial cell.

Targets.
1. Show knowledge of theoretical material on the studied topics.
2. Be able to determine and differentiate histological structures of tissues in micro-preparations.
3. Solve situational problems and tests.

Control question:
1. General characteristics of epithelial tissue.
2. Classification of the epithelium.
3. Single-layer epithelium, types, localization, structural features.
4. Multilayer epithelium, types, localization, structural features.
5. Glands, structure, classification, function. Secretory cycle of the glandular cell.
6. General characteristics of blood and lymph as tissues (development, structure, function, ability to regenerate).
7. Classification of formed elements of blood.
8. The concept of the hemogram and leucocytic formula.
9. Morphological characteristics of shaped blood elements.
10. Modern understanding of the mononuclear phagocyte system and the participation of T and B lymphocytes in cellular and humoral immunity.
11. Classification of the groups of connective tissues. Contribution of Russian scientists to the development of the doctrine of tissues (A. A. Maksimov, A. A. Zavarzin, V. G. Eliseev).
12. Sources of development, structure, functional significance and localization of certain types of fibrous connective tissue.
13. Cellular composition of connective tissues, morphological and functional characteristics of cells.
14. Intercellular substance of connective tissues, morphological and histochemical characteristics. Participation of fibroblasts and mast cells in the formation of intercellular substance.
15. Features of the structure of connective tissues with special properties.
16. General characteristics of cartilage tissue. Classification and topography of cells and intercellular substance.
17. Cartilage as an organ. Structure of the epiglottis and its role in nutrition, growth and regeneration of cartilage.
18. Features of the structure and localization of various types of cartilage tissue.
19. General characteristics of bone tissue. Cells and intercellular substance.
20. Classification of bone tissue. Morphofunctional characteristics of various types of bone tissue.
21. Structure of the tubular bone as an organ. Histotopography of blood capillaries and cambial elements.

Micropreparations
1. Mesothelium of the omentum (painted with silver nitric acid)
2. Single layer cuboidal epithelium of tubules of kidneys (coloration of Gema-doxylin-eosin)
3. Multi-row scintillating epithelium in the trachea preparation (hematoxylin-eosin stain)
4. Multilayer non-corneal epithelium in the preparation cornea of the eye (color hematoxylin-eosin)
5. Multi-layer keratinizing epithelium in the preparation finger skin (hematoxylin-eosin stain)
6. Multilayered transitional epithelium in the preparation of the bladder (hematoxylin-eosin stain)
7. Smear of human blood (staining according to the method Romanovsky)
8. Frog blood smear (Romanovsky staining)
9. Decorated dense connective tissue in the substance of the tendon (coloration with hematoxylin-eosin)
10. Dense unformed connective tissue in the preparation finger skin (color hematoxylin-eosin)
11. Adipose tissue in the preparation of the omentum of man (stained with Sudan III)
12. Reticular tissue in the lymph node preparation (staining with hematoxylin-eosin)
13. Hyaline cartilage (hematoxylin-eosin stain)
14. Elastic cartilage (paint gorseinon)
15. Fibrous cartilage (hematoxylin-eosin stain)
16. Lamellar bone tissue (dyed by the method of schmorl's)
Test task.

TOPIC: MUSCLE TISSUE.
PC-9

I. Motivational characteristics of the topic.
Muscle tissue is a group of tissues of the body of different origin, United by the sign of contractility. Various forms of movement of the body and its functions are associated with muscle tissues: movement of the body in space, heart contractions, movement of blood through the vessels, urination, movement of food masses through the intestines, etc.the Biological nature of a person is such that it requires the mandatory normal action of all systems and organs, otherwise their vital activity decreases and atrophy may occur. First of all, this applies to the muscular system of the

body. In addition, muscle tissues Deposit energy material; when the structure and function of muscle tissues are disrupted, severe diseases occur. This makes it necessary for a detailed study of muscle tissue by a future doctor.

II.Targets.
1. Study the structural basis of the mechanism of muscle contraction.
2. Be able to compare micro -, ultra -, and histochemical data with the functional state of muscle fibers.
3. Explain the structural and functional features of various groups of muscle tissues.

III.The required initial level of knowledge.
a) from the previous topics:
1. Cell organelles.
2. Non-cellular tissue structures.
b) from the current session:
1. Classification and features of the structural organization of muscle tissues.
2. Structure of skeletal and cardiac muscle tissues.
3. Features of the structure of myofibrils as a structural and functional unit of muscle fiber.
4. Structure of smooth muscle tissue.
5. Sources of development and methods of muscle tissue regeneration.

IV.Object of study.
a) micro-products for self-study:
1. Smooth muscle tissue in the preparation "bladder" (stained with hematoxylin-eosin).
2. Striated muscle tissue in the preparation "rabbit's Tongue "(staining with iron hematoxylin).

V. Information part.
Muscle tissue - a group of tissues of the body of different origin, United on the basis of contractility. There are two groups of tissues: striated (striated) skeletal and cardiac and smooth (non-striated). The reduction of muscle tissue is carried out due to the presence of organoids of special significance - myofibrils. In the structure of myofibrils there are contractile proteins: actin, myosin, troponin, tropomyosin, due to which, and in the presence of CA ions, shortening of the muscle fiber occurs. The transverse striation of the skeletal muscle fiber is determined by the regular alternation in myofibrils of differently refracting polarized light sections (disks)- light, isotropic - I disks and dark, anisotropic-A disks. Light disks are formed by actin, dark disks are formed by myosin. Protein strands attached to teleprogram and metapragmas. To teleprogram – actin, for metapragmas myosin filament. On the longitudinal section, the telophragms look like lines called Z-lines. The portion of the myofibrils located between the two telegramme is called a sarcomere. The part of the sarcomere occupied by the M-line (mesophragma) and adjacent zones where only myosin filaments are located is called the H-zone. Myofibrils are surrounded by loops of the agranular endoplasmic network (sarcoplasmic reticulum), in which calcium ions accumulate. At the level of telophragms, the cytolemma is localized in the transverse tubules, or T-tubules. The tubules of the sarcoplasmic reticulum reach the T-tubes, forming the final (terminal) cisterns, go parallel to them and accompany each of the tubes. The tubules of the T-system and terminal tanks form triads. Around the myofibrils, mitochondria form a chain.
The reduction process is the shortening of myofibrils within the sarcomere. The action potential extends through the sarcolemma and T-tubes. Calcium ions are released from the sarcoplasmic network, enter the myofibrils, interact with the regulatory protein troponin, releasing the active centers of the actin protein. Specialized side surfaces of myosin-myosin heads, using the energy of ATP, move actin filaments and bring the ends of the latter to the M-line.
There are red muscle fibers (type I), white muscle fibers (type II) and transitional forms. Type I fibers contain slow-type myosin ATPase, high-activity SDG, and high content of myoglobin and glycogen. Type II fibers contain fast-type myosin ATPase, low SDH activity, more glycogen inclusions, and less myoglobin.
Smooth muscle tissue is formed by spindle-shaped myocytes. Actin myofilaments are located at an angle or longitudinally with respect to the long axis of the cell. Calcium ions enter the cell from vpachivani formed by cytolemma - pinocytotic bubbles and kahweol.
Heart muscle tissue is formed by cardiomyocytes. There are several types of cardiomyocytes: contractile, conducting, transitional (intermediate), secretory.
Contractile cardiomyocytes have an elongated almost cylindrical shape. Their ends connect to each other, forming functional fibers. Insert disks are located in the contact area. The nucleus (one or two) is located in the center of the cell.
Regeneration of muscle tissue: a) striated musculature has cambial cells-myosatellitocytes; b)smooth – compensatory hypertrophy of smooth muscle cells, some myocytes divide, myofibroblasts turn into myocytes; C) heart muscle tissue is not restored, because definitive cardiomyocytes have lost the ability to mitotic division.

VI.Learning activity.
1.Find and draw smooth myocytes that have an elongated fusiform shape in the longitudinal section (1) on the micro - product "Bladder". In the center of the cell, the rod-shaped nucleus (2) is well defined. There are collagen and

elastic fibers around the group of cells (3). In cross-section, the cells and their nuclei have a rounded shape, and myofibrils are clearly visible, located on the periphery of the cell in the form of pink dots (4). Between the longitudinally and circularly arranged layers of muscles, layers of loose fibrous connective tissue are visible (5).
2.On the micro-product "Leaf-shaped papillae of the tongue" find and draw striated muscle fibers (1), which have a longitudinal section of the form of cylindrical strands. From the surface, the muscle fiber is covered with a sarcolemma (2), under which flattened nuclei (3) are located on the periphery. In fibers cut along the axis, the cores are located on the sides. Striated muscle tissue is characterized by longitudinal and transverse striation. The longitudinal striation is explained by the presence of myofibrils (4). Between the muscle fibers are visible layers of connective tissue, called endomysium (5), they bind the muscle fibers and pass into the fibrous backbone of the sarcolemma. The nuclei of endomysium cells (6) differ from the muscle nuclei in their elongated shape and high content of chromatin, which makes them more colored. Cross sections of muscle fibers (7) have a rounded shape, and the peripheral location of the nuclei is clearly visible. Cross sections of myofibrils (8) have the form of dots. Thin layers of endomysium are visible around each fiber (5).
3.Draw and mark drawings

VII.Control question.
1.Features of the structure of various types of muscle tissue, sources of development, localization, classification.
2.Striated muscle tissue, structural mechanisms of muscle contraction.
3.What are T-tubes? What is their relationship to the endoplasmic network and their role in muscle contraction?
4.Smooth muscle tissue, structural mechanisms of muscle contraction.
5.Features of the structure of heart muscle tissue.

VIII.Learning objective.
1. On the electronogram of myofibrils, the disks Are not detected, the telophragms are close to disk A. in what phase of functional activity is the muscle fiber?
2.The experiment examines tissue that contracts tonally and is almost indefatigable. What kind of fabric is this? What part of the nervous system is it inervated by?
3.In a conditional experiment, the t - system was destroyed in a striated muscle fiber. Will the ability of the muscle fiber to contract change?
4.The chemical inhibits the entry of CA ions into the sarcoplasm. How will this affect the function of muscle tissue?
5.The rats swam in the pool for a long time. The study of the state of their skeletal muscles revealed almost complete disappearance of glycogen in them, an increase in the number of mitochondria and the enlightenment of their matrix. What is the function of cells is in an extremely stressed state? What are the reasons for these morphological changes in mitochondria? Why did glycogen disappear?
6.In smooth muscle tissue, a nerve fiber approaches a single cell, and in response, a whole group of 8-9 cells contracts. Explain how the pulse reaches cells that do not have contact with the nerve fiber?
7.A pathological process destroyed the insertion disk between cardiomyocytes. What will this violation lead to?
8.As a result of the heart attack, damage to the heart muscle occurred. What cellular elements will ensure the restoration of the defect in the structure of the organ?

IX.The topics of structural abstracts.
1. Modern ideas about the histophysiology of striated muscle fiber.
2. Mechanism of regulation of contraction and relaxation of striated muscle tissue.
3. Myosin and biological mobility.
4. Structures and functions of proteins of contractile systems.

INDEPENDENT WORK
II. THE STUDENT SHOULD KNOW:

1.Classification and features of the structural organization of muscle tissues. 2.Structure of skeletal and cardiac muscle tissues. 3.Features of the structure of myofibrils as a functional unit of muscle fiber. 4.Structure of smooth muscle tissue. 5.Sources of development and methods of muscle tissue regeneration.	1.Histology: textbook / edited by Yu. I. Afanasiev, N. A. Yurina. - 5th ed., pererab. and add. - M.: Medicine, 2006. 2.Histology: textbook / Under the editorship of E. G. Ulumbekova, J. A. Chelysheva. - 2nd ed., pererab. and add. - M.: GEOTAR-MED, 2009. 3. Methodological guide for students in histology. Part 1. L. A. Akoeva, L. A. gireeva, L. S. Tabolova, and others. Vladikavkaz, 2008.

II.THE STUDENT MUST BE ABLE TO:
1. Compare micro -, ultra -, and histochemical data with the functional state of muscle fibers.-
2. Explain the structural and functional features of various groups of muscle tissues.-

III. Tasks to prepare for the lesson:

Task 1. Fill in the missing information
Types of muscle tissue:
1.
2.
3.
Striated muscle tissue:
1.Structurally functional unit of a myofibril -....., includes ……
Dark disks are formed.....
Light disks are formed.....
Z-line this .....
Myosin protofibrils consist of:.....
Protofibrils consist of actin: from……

The task № 2. Continue with the phrases and fill in the table. «Types of muscle fibers»

	Red muscle fibers (fiber I, or slow type)	White muscle fibers (fiber II, or fast type)
Functional ability	Capable of	Capable of
Myoglobin	a) a. The fiber content of myoglobin - ..... b) b. from Here - ..... color of the fibers.	a) a. myoglobin Content– …….... b) Hence the color of the fibers. Glycogen content -.....
Glycogen	In the fibers of glycogen ..... •	Glycogen content -…….

Task 3. Smooth muscle tissue. Continue your sentences.
Cells ..... striation, contain .....rod-shaped....., located .....
(number) In the cell is well developed.....,. the synthesis of intercellular substance components occurs(.....)
Smooth myocytes do not have T-tubes, L-tubules, and terminal cisterns, as in skeletal and cardiac tissues. The plasmolemma forms numerous vypyachivaniya - ..... These entities participate in ……
Thin (actin) are attached to microfilaments..... (analogs of the Z-strip),
which ……..
…….....
Thick (myosin) microfilaments are embedded between only .....
Task 4. Heart muscle tissue. Continue your sentences.
Functional fibers: consist of ……
The borders between the latter are called ..... disks.
Types of contacts between neighboring cardiomyocytes: desmosomes, interdigitations, and nexuses. ……....
provide an electrical connection between cardiomyocytes.
In the region of insert disks in the plasmolemma of cardiocytes there are zones ……
The content of myofibrils .....they occupy about 40 % of the cell volume. In the cell there are .....kernel
They occupy .....position.
Biosatellites and stem cells are not; therefore, the new functional cardiomyocytes and fibers during regeneration .....

Task 5. Make 2-3 test tasks based on the sample.
Fast-rotating white muscle fibers are characterized by:

1. rapid myosin
2. high activity of myosin Arfaz
3. low myoglobin content
4. high activity of succinate dehydrogenase.

IV. Questions for self-monitoring
1. Features of the structure of various types of muscle tissue, sources of development, localization, classification.
2. Striated muscle tissue, structural mechanisms of muscle contraction.
3. What are T-tubes? What is their relationship to the endoplasmic network and their role in muscle contraction?.
4. Smooth muscle tissue, structural mechanisms of muscle contraction.
5. Features of the structure of heart muscle tissue.

TEST YOURSELF:

CHOOSE ONE CORRECT ANSWER
1. What is included in the sarcomere?
a. Half of disk I, disk A, and another half of disk I.
b. Disk A and disk I.
c. Disk A and half of disk I.
d. Disk 1 and half of disk A.
a. Half of disk A, disk I, and another half of disk A.

2. In what way is the spread of excitation in the muscle fiber?
a. By the cytolemma.
b. By the sarcotubular system.
c. On the cytoplasmic granular network.
d. On the cytolemma and sarcotubular system.
f. By microtubules.

3. What tissue is located between the muscle fibers of skeletal muscle tissue?
a. Reticular tissue.
b. Dense unformed connective tissue.
c. Dense decorated connective tissue.
d. Loose fibrous connective tissue.

4.Which of these structural features are NOT characteristic of the heart muscle?
a. Location of the nuclei in the center of the cardiomyocyte.
b. Location of the nuclei on the periphery of the cardiomyocyte.
c. The presence of insert disks.
d. The Presence of anastomoses between cardiomyocytes.

SELECT THE CONDITION UNDER WHICH THIS STATEMENT IS TRUE
5. What proteins are included in the myofibrils?
a. Myosin.
b. Actin.
c. Keratin.
d. Collagen.

6. What are the signs of skeletal muscle tissue:
a. Formed by cells.
b. The Cores are located on the periphery.
c. Consist of muscle fibers.
d.Has only intracellular regeneration.
f. Develops from myotomes.

7. Which organelles of the following are NOT contained in cardiomyocytes?
a. Organelles of General significance.
b. Tonofibrils.
c. Neurofibrils.
d. Myofibrils

8. What happens when the sarcomere contracts?
a. Shortening of actin and myosin myofilaments.

b. Reducing the width of the "N" zone.
c. Convergence of telophragms (Z - lines).
d. Reducing the width of the A - disk.
f. Occurrence of actin myofilaments between myosin ones.

9. The difference between cardiac muscle tissue and skeletal?
a. Consist of cells.
b. The Nuclei are located in the center of the cells.
c. Myofibrils are located on the periphery of cardiomyocytes.
d. Muscle fibers do not have transverse striations.
f. Muscle fibers anastomose with each other.

10. What is the difference between smooth muscle tissue and striated skeletal tissue?
a. Consists of cells.
b. It is Part of the walls of blood vessels and internal organs.
c. Consists of muscle fibers.
d. Develops from somite myotomes.
f. Does not have striated myofibrils.

TOPIC: NERVE TISSUE. NEUROCYTES. NEUROGLIA.
PC-9

I. Motivational characteristics of the topic.
The value of nerve tissue in the body is determined by the main properties of nerve cells to perceive irritation, to come to a state of excitement, to produce an impulse and transmit it. Being highly specialized, the nervous tissue in the body and systems regulates the activity of tissues and organs, their relationship and connection with the environment, i.e. provides correlation of functions, integration and adaptation of the body. All elements of the nervous tissue are morphologically and functionally a single system of the body.
II.Targets.
1.To study the morphological structure and functional features of nerve cells and neuroglia. Know the classification of nerve cells.
2.Be able to identify nerve cells and neuroglia cells by morphological features.

III.The required initial level of knowledge.
a) from the previous topics.
1. Structure of cells and organoids of special significance.
2. The concept of the tissue system.

b) from the current session
1. Source of development of nervous tissue, components of nervous tissue.
2. Morphological and functional classification of neurocytes.
3. Classification of gliocytes and their functional significance

IV.Object of study.
a) micro-products
1. Spinal cord (silver nitric acid staining)
2. Spinal node (hematoxylin-eosin stain)
3. Cerebellum (colored with silver nitric acid)
4. Cortex of the brain (silver nitric acid staining)
V. Information part.

Nerve tissue regulates the activity of tissues and organs, their relationship and connection with the environment. Nerve tissue consists of nerve cells-neurons that perform a specific function, and neuroglia that provides the existence and specific function of nerve cells.

Neurons, or neurocytes, differ in their functional significance and morphological features. By functional value, neurons are divided into receptor (sensitive, or afferent), associative (insertion), effector (efferent). The first generate a nerve impulse, the second-carry out connections between neurons, the third-transmit excitement to the working organ. The size of neurocytes is from 4-6 microns to 130 microns. Nerve cells have a body and processes. According to the shape of the body, there are star-shaped, pear-shaped, pyramid-shaped, and rounded shapes. The length of the processes of neurons ranges from a few microns to 1-1. 5 m. By functional value, the processes are divided into axons (neurites) and dendrites. Dendrites conduct an impulse to the body of the nerve cell, the axon

diverts the impulse from the body. The axon of a nerve cell is always 1, dendrites-1 or more. According to the number of processes, neurons are unipolar (one process), bipolar (two processes), and multipolar (more than two processes). There are no true unipolar cells in the human body,and the group of bipolar cells includes pseudo-unipolar. Neurons have well-developed neurofibrils (bundles of neurofilaments and neurotubules). The chromatophilic substance (Nissl substance) is a portion of the granular endoplasmic network (located in the pericaryons and dendrites of cells).

Neuroglia is formed by cells that ensure the performance of basic functions by neurocytes. Among glial cells, there are two genetically distinct species: macroglia (the gliocytes) and microglia. Among the distinguished ependymal gliocytes, astrocytes, oligodendroglia. Ependymocytes (epithelial-like cells) line the spinal canal and ventricles of the brain. On the apical surface there are cilia, some of which are reduced. From the basal-branch processes that cross the entire nerve tube, reaching its outer surface and forming a surface glial boundary membrane. Perform delimiting, supporting and secretory functions. Astrocytes, small cells with numerous processes. There are protoplasmic (short-spun, short-spun) and fibrous (long-spun, long-spun). Protoplasmic cells are located in the gray matter, and they perform differentiation, trophic, and support functions. The fibrous ones are mainly located in the white matter, perform a supporting, delimiting, and also isolate neurons from external influences. Oligodendrogliopathy the most numerous of glial cells. They surround the bodies of neurons in the Central and peripheral nervous system, are part of the nerve membranes. They have different shapes and have several appendages.

VI.Learning activity.
1.On the microparameter "Spinal cord" to find and consider in the gray matter a multipolar cell of stellate shape(1), having processes (2), in the cytoplasm of which (3) there is a rounded light core (4), poor in chromatin.
2.On the micro-drug "Spinal node" to find and consider a pseudo-bipolar cell of a rounded shape (1), the only process of which is difficult to distinguish in the drug. The cell body is surrounded by satellite cells (2), which are elements of oligodendroglia.
3.On the microparameter "Cerebellum" in gray matter, find and consider a multipolar pear-shaped cell (1), with well-defined processes (2).
4.Find and examine a multipolar pyramid-shaped cell (1) with well-defined appendages (2) on the microparticle "Cortex". In the center of the cell, a rounded light core (3) is defined.
5.Fill in the table.

Title	Drawing of the cell	Functions	Source of development	Localization

6. Draw and mark drawings:

VII.Control question.
1.Microscopic structure of neurocytes and sources of their development. Structure of neurons in various parts of the nervous system.
2.Morphological and functional classification of neurons.
3.Types of neuroglia, localization, structure, sources of development, functions.

VIII.Learning objective.
1.Two preparations of nervous tissue are presented: on the first - a large number of lipofuscin grains are allocated in the cytoplasm of neurocytes, on the second - lipofuscin is absent. Which age group does the drug belong to?
2..The diagram shows the cellular elements of neuroglia: 1-cylindrical cells with cilia on the apical surface; II-small cells with numerous processes. What type of gliocyte do these cellular elements belong to?
3.The gray neurocytes are irreversibly damaged by the pathological process
substances of the spinal cord. What cellular elements will participate in neuronophagia?
IX.The topics of structural abstracts.
1. Neurons of the cerebral cortex in the system organization
2. From neuron to brain.

INDEPENDENT WORK
I. THE STUDENT SHOULD KNOW:

1. Sources of development and components of nervous tissue. 2. Morphological and functional classification of neurons and neuroglia.	1.Histology: textbook / edited by Yu. I. Afanasiev, N. A. Yurina. - 5th ed., pererab. and add. - M.: Medicine, 2006. 2.Histology: textbook / Under the editorship of E. G. Ulumbekova, J. A. Chelysheva. - 2nd ed., pererab. and add. - M.: GEOTAR-MED, 2009. 3. Methodological guide for students in histology. Part 1. L. A. Akoeva, L. A. gireeva, L. S. Tabolova, and others. Vladikavkaz, 2008.

II. THE STUDENT MUST BE ABLE TO:
At the microscopic level, identify different types of neurons, distinguish between myelin and non-myelin nerve fibers, identify effector and receptor nerve endings.

III. Tasks to prepare for the lesson.
Task 1. Add the missing information.
By function, neurocytes are divided into 3 types:
sensitive (or receptor), associative, and effector.
Sensory neurons .....signals
against ……. receptors'.
These signals are most often transmitted to ..... nervous system,
The bodies of neurons are located .....
……..... Associative neurons transmit signals from .....
They are located in ..... nervous system,
Effector neurons transmit signals .....
on .....The bodies of these cells are……
Among the processes of neurons, dendrites and axons are distinguished.

Dendrites	Axon (neurite)
These are the appendages that the impulse goes through ..... neuron's.	This is the process along which the impulse goes ..... neurons.
b) the Cell can have ..... ……..... dendrites'.	b) the Axon ……

The task № 2. Fill in the table " Neuroglia»

Neuroglia cells.	Source of development.	Functions	Localization

Macropolicy: • Ependymocytes			
•			
•			
•			
•			

Task 3. Make 2-3 test tasks based on the sample.
Which cells can be considered pseudounipolar
a. with one process
b. with two appendages
c. with three appendages
d. with a single process that branches T-shaped

IV. Questions for self-monitoring:
1.Microscopic structure of neurocytes and sources of their development. Structure of neurons in various parts of the nervous system.
2.Morphological and functional classification of neurons.
3.Types of neuroglia, localization, structure, sources of development, functions.

TEST YOURSELF:
CHOOSE ONE CORRECT ANSWER
1. What functions do microglia cells perform?
a. Generate a nerve impulse.
b. Trophic.
c. Delineation.
d. Protective.
f. Secretory.

2. What organoids form a chromatophilic substance in the cytoplasm of neurons?
a. Mitochondria.
b. Lysosomes.
c. Dictyosomes of the Golgi complex.
d. Smooth cytoplasmic network.
f. Granular endoplasmic network.

3. Everything is present in the axon except:
a. Mitochondria.
b. Vesicle.
c. Microtubules.
d. Basophilic substance (nissl substance).
f. Neurofilaments.

4. What morphological types of neurons are most common in mammals?
a. Unipolar.

b. Multipolar.
c. Pseudo-Bipolar.
d. Bipolar.
f. Non-polar.

5. Where are the ependymocytes located?
a. Line the ventricles of the brain and the Central channel of the spinal cord.
b. Surround large neurons of the brain.
c. Accompany the nerve fibers.
d. Surround the blood vessels.

6.The axonal mound is typical for:
a. Dendrites
b. The body's nerve cells
c. Axon
d. Microglia

7. Dendrite
a. Removes the impulse from the cell
b. Leads the impulse to the cell
c. Conducts a pulse inside the cell
d. Provides interaction of cell structures

SELECT THE CONDITION UNDER WHICH THIS STATEMENT IS TRUE
8. Structural components of nervous tissue:
a. Neurons.
b. Neuroglia.
c. The Main (amorphous) substance.
d. Reticulin fibers.

9. What applies to macroglia?
a. Ependymocytes.
b. The astrocytes.
c. Oligodendrocytes.
d.The city of the Giant neurons of the cerebral cortex.
f. Glial macrophages.

10.Oligodendroglioma is
a. Microglia Cells.
b. Processes of nerve cells.
c. Variety of macroglia
d. There Are no correct answers

TOPIC: NERVE TISSUE. NERVE FIBER. NERVE ENDING.

PC-9

I. Scientific and methodological justification of the topic.

The value of nerve tissue in the body is determined by the main properties of nerve cells to perceive irritation, to come to a state of excitement, to produce an impulse and transmit it. Being highly specialized, the nervous tissue in the body and systems regulates the activity of tissues and organs, their relationship and connection with the environment, i.e. provides correlation of functions, integration and adaptation of the body. All elements of the nervous tissue are morphologically and functionally a single system of the body.

II. Targets.

THE STUDENT SHOULD KNOW:

1.At the microscopic level, the structure and functional features of various types of nerve fibers and the process of myelination.
2.Microscopic, ultramicroscopic, and functional features of nerve endings.
The student must be able to:
1.Explain simple and complex reflex pathways typical of the somatic and autonomic nervous systems.
2. In micro-preparations, determine myelin and non-myelin nerve fibers.
3. Find and differentiate different types of nerve endings in micro-preparations.

III. The required initial level.
a) from the previous topics.
1.Morphological and functional classification of neurocytes.
2.The functional significance of the appendages of neurocytol.
3.Oligodendroglia and their functional significance.
b) from the current session
1.The concept of nerve fibers, their classification and structural features.
2.The principle of structural organization of chemical and electrical synapses.
3.Structure of nerve endings and their classification.
4.Structure and classification of synapses.

IV. Object of study.
a) micro-products for self-study:
1. Myelin-free nerve fiber (hematoxylin-eosin stain)
2. Myelin nerve fiber (silver nitric acid staining)
3. Motor nerve endings (silver nitric acid staining)
4. Vater-Pacini body (hematoxylin-eosin color)
b) electronic messages
№ 193, 192, 195, 197, 211, 212.

V. Information part
The processes of nerve cells covered with membranes are called nerve fibers. In accordance with the characteristics of the structure of the membranes of all nerve fibers are divided into two main groups - the myelin and bezmalinovic. In the center of the fiber is a process of the nerve cell or axial cylinder, which is surrounded by shells formed by cells of the oligodendroglia. Myelin-free nerve fibers are found primarily in the autonomic nervous system. They usually contain several axial cylinders (cable-type fibers). Shell lemmocytes caving in, tightly covers the axial cylinder. The double membrane of the lemmocyte forms a mesaxon. Myelin nerve fibers are located in the Central and peripheral nervous system. They are thicker bezmalinovic. Their shell consists of both the inner myelin layer and the outer one - the neuro-Lemma, consisting of the cytoplasm and nuclei of neuro-lemmocytes. The myelin layer is formed by mesaxon whorls. At a certain distance in this layer there are myelin notches (Schmidt – Lanterman notches). A section of fiber without myelin is called a nodal intercept (Ranvier intercept). A segment of fiber located between two interceptions is called an interstitial segment.

The end devices of nerve fibers are called nerve endings. By functional value, nerve endings are divided into three groups: effector, receptor, and terminal devices that form interneuronal synapses and connect neurons to each other. Effector nerve endings are of two types – motor (motor) and secretory. Motor endings of striated muscles are called neuromuscular endings. Myelin fiber in the end loses the myelin layer, bends the sarcolemma of the muscle fiber. The terminal branches of the nerve fiber contain mitochondria and presynaptic vesicles with a mediator-acetylcholine. The plasmolemma of the terminal branches forms a presynaptic membrane. The postsynaptic membrane is formed by a sarcolemma, on the surface of which the receptors are located. Both membranes are separated by a synaptic cleft. Receptor nerve endings (receptors) are: external and interoreceptors. Depending on the specific characteristics of the stimulus-chemo -, Baro -, thermo -, mechanoreceptors, etc. According to the structure features-free receptors (formed by the terminals of the axial cylinder) and non-free (contain the axial cylinder and gliocytes). Non-free are divided into non-encapsulated (no connective tissue capsule) and encapsulated (covered with a connective tissue capsule). Receptors of the skeletal muscles – neuromuscular and neuromuscular tendon spindles. Neuromuscular-consists of two types of intrafusal fibers - with a nuclear bag and a nuclear chain. Two types of afferent fibers are suitable for intrafusal muscle fibers: primary (ring – like endings) and secondary (cluster-like endings). Interneuron synapses are the place where nerve cells contact. Distinguish synapses with chemical transmission (chemical) and electrical transmission (electrical) the Latter in higher animals are rare. The synapse consists of a presynaptic part (an axon branch, with clusters of mitochondria and presynaptic vesicles), and a postsynaptic part (the plasmolemma of another neuron, with receptors on the surface and submembrane seals of the cytoplasm). There is a synaptic cleft between them. By localization, there are axosomatic, axodendritic, and axoaxonal synapses. By function, there are: excitatory and inhibitory. The chemical transmitter (mediator) is biologically active substances - acetylcholine, norepinephrine, dopamine, glycine, etc.the Impulse in such synapses is transmitted only in one direction.

VI. Learning activity.

1.Find and draw an intact isolated fiber (1) in the center of which is an axial cylinder (2), and along the periphery of the fiber are flattened lemmocyte nuclei (3).

2.On the micro-product "Myelin nerve fiber" find and draw an intact nerve fiber (1),in the center of which there is an axial cylinder (2), outside - the myelin sheath (3), colored with osmium. Along the course of the fiber, there are noticeable breaks in the myelin sheath in the form of annular constrictions - Ranvier interceptions (4), here the axial cylinder is devoid of myelin sheath. Along the course of the myelin sheath, oblique light lines are visible that cross the entire thickness of the myelin, called Schmidt – Lanterman notches (5). A neurilemma is located on top of the myelin sheath. It is better visible at the locations of the Schwann cell nuclei(6).

3.On the micro-product "Motor nerve endings" find and draw in the striated muscle tissue (1) impregnated with silver nerve trunks (2). Along the course of the axial cylinders, the nuclei of Schwann cells (3) are visible. From the bundle, individual nerve fibers bend to a specific muscle fiber and, losing the myelin layer, form a motor plaque (4). It is distinguished by a group of relatively large, weakly colored silver cores, often located in a rosette.

4.Find and draw the encapsulated nerve endings (1) on the microparameter "Vater-Pacini body", in the center of which the internal flask (2) stands out on the section. The outer flask is formed by a set of concentric connective tissue plates (3), between which the nuclei of cells (4) of connective tissue are visible.

5.Mark the drawings.

VII. Control questions for checking the final level of knowledge:

1.Nerve fibers, their structure, localization, functional features.
2.Nerve endings, classification, structure.
3.The concept of interneuronal synapses.
VIII. Learning objective.
1.The speed of transmission of the nerve impulse of various nerve fibers is studied. It was found that the speed of excitation in the first - 1-2 m\sec., the second - 5-120 m\sec. What type are the first and second nerve fibers?
2.The animal was cut through the mixed nerve. Which neurocyte processes are damaged?
3.Severed nerve fiber. For drug discovered club-shaped extension of the axial cylinder (bulb growth). What part of the nerve fiber does the study area belong to?
4.One of the preparations shows the final branching of the axial cylinder, accompanied by gliocytes, while the other shows the branching of the axial cylinder only. What is the morphological type of the first and second nerve endings?
5.A rough connective-tissue scar appeared where the nerve fiber had been cut. How will this affect the process of regeneration of the nerve fiber?
6.The patient developed paralysis, i.e. it became impossible to move the paralyzed part of the body. Damage to what structures in the three-membered reflex arc could cause paralysis?
7.In two patients, the limbs do not respond (do not pull back) to tingling. In this case, the first patient feels pain when tingling, the second-does not feel any pain, or the tingling itself. Damage to what structures (levels) in the three-membered reflex arc in the first and second patient could be the cause of the described condition?
8.The patient feels pressure on the skin, but does not feel pain and light touch to the skin. Which receptors in the patient's skin are damaged and which are not damaged?

INDEPENDENT WORK
I. THE STUDENT SHOULD KNOW:

1.Features of the structure of nerve fibers and the mechanism of their formation. 2. Structure of nerve endings and their classification. The principle of structural organization of interneuron synapses. 3.Reflex arc.	1.Histology: textbook / edited by Yu. I. Afanasiev, N. A. Yurina. - 5th ed., pererab. and add. - M.: Medicine, 2006. 2.Histology: textbook / Under the editorship of E. G. Ulumbekova, J. A. Chelysheva. - 2nd ed., pererab. and add. - M.: GEOTAR-MED, 2009. 3. Methodological guide for students in histology. Part 1. L. A. Akoeva, L. A. gireeva, L. S. Tabolova, and others. Vladikavkaz, 2008.

II. THE STUDENT MUST BE ABLE TO:

At the microscopic level, identify different types of neurons, distinguish between myelin and non-myelin nerve fibers, identify effector and receptor nerve endings.

III. Tasks to prepare for the lesson.
Task 1. Fill in the table «Nerve fibers»

	Myelin fibers	non-Myelin fibers
Number of axial cylinders		
Shells		
Characteristic features of the structure		
Distinctive features in the structure		

The speed of the pulse		
Localization		

The task 2. Continue the sentence
The end of the dendrite is _____nerve endings. According to the structure in the epithelium of these endings _____, in the connective tissue_____. By the nature of the perceived stimuli, there are endings_____, _____, _____, _____.
The end of the axon called _____. As part of this ending, there are 3 components: _____, _____, _____.

The task 4. Make 2-3 test tasks based on the sample.
Nerve fibers consist of:
1. Process of the nerve cells
2. Surrounded by glia cells
3. Conduct nerve impulses
4. Occur in the embryonic period

IV. Questions for self-monitoring:
1.Nerve fibers, their structure, localization, functional features.
2.Nerve endings, classification, structure. The concept of interneuronal synapses.

TEST YOURSELF:
CHOOSE ONE CORRECT ANSWER
1. How is the presynaptic part of the interneuronal synapse formed?
a. the Axon of a neuron.
b. The dendrite of the neuron.
c. the body of the neuron.

2. Where are the synaptic vesicles located?
a. in the presynaptic part of the synapse.
b. in the postsynaptic part of the synapse.
c. in the synaptic cleft.

3. What types of neurons and their processes form afferent nerve endings?
a. dendrites of efferent neurons.
b. Axons of insertion neurons.
c. Axons of afferent neurons.
d. Dendrites of afferent neurons.

4. Where are the ependymocytes located?
a. Line the ventricles of the brain and the Central channel of the spinal cord.
b. Surround large neurons of the brain.
c. Accompany the nerve fibers.
d.They Surround the blood vessels.

5. What is present in the myelin-free nerve fiber?
a. Myelin sheath.
b. Only one axial cylinder.
c. Several axial cylinders.
d. Interstitial segments.

6. What group of nerve endings are lamellar corpuscles?

a. non-encapsulated sensitive nerve endings.
b. Encapsulated sensory nerve endings.
c. Free afferent nerve endings.
d. Secretory nerve endings.
f. Motor nerve endings.

7. How is the presynaptic part of the interneuronal synapse formed?
f. Axon of the neuron.
b. The Dendrite of the neuron.
c. The body of a neuron.

SELECT THE CONDITION UNDER WHICH THIS STATEMENT IS TRUE
8.What is present in the myelin nerve fiber?
a. Nodal intercepts.
b. Mesaxon.
c. Schwann cells.
d. Several axial cylinders.

9. What is the function of the axial cylinder of the nerve fiber?
a. Conducting a nerve impulse.
b. Providing the plasma current.
c. Generation of a nerve impulse.
d. Movement of the neurocyte.

10. What are the structural elements of the nervous tissue form the nerve fibers?
a. oligodendroglia Cells.
b. Microglia Cells.
c. Fibrous astrocytes.
d. Plasma astrocytes.
f. Processes of nerve cells.

TOPIC:THE NERVOUS SYSTEM. PERIPHERAL NERVOUS SYSTEM. SENSITIVE NERVE NODES. SPINAL CORD. AUTONOMOUS (AUTONOMIC) NERVOUS SYSTEM. REFLEX ARC.

PC-9

I. Motivational characteristics of the topic.
The activity of the nervous system is based on the principle of reflex arcs, which are a chain of neurons that have special functional purposes (afferent, associative, efferent) and are located in different parts of the nervous system. Knowledge of the histophysiology of the peripheral nervous system (nerve, nerve nodes) and Central (spinal cord and brain) is necessary for understanding the integrating and coordinating functions of the nervous system and for correct diagnosis of diseases associated with disorders of these organs.
II.Targets.
1. To study the morphological structure of the peripheral and Central nervous system organs.
2. Be able to determine their structural elements on a microscopic level.
3. To study the features of the morphological structure and functioning of the autonomic nervous system.
4. Be able to reproduce simple and complex reflex arcs typical of the somatic and autonomic nervous system, taking into account their characteristics at the organ and cellular levels.

III.The required initial level of knowledge.
a) from the previous topics.
1. Histogenetically classification of neurocytol.
2. Histogenetically classification of glial.
3. Structure of myelin and non-myelin nerve fibers.
4. The structure of the nerve endings.

b) from the current material.
1. Histogenetically features of spinal and autonomic ganglia.
2. Features of the structure of the gray and white matter of the Central nervous system.
3. The concept of nuclear-type nerve centers.
4. The main nuclei of the spinal cord.

5. Somatic and vegetative reflex arcs.

IV.Object of study.
a) micro-products for self-study.
1. Spinal node (hematoxylin-eosin stain)
2. Intramural ganglion (silver nitric acid staining)
3. Spinal cord (silver nitric acid staining)

V. Information part.
The nervous system regulates all life processes in the body and its interaction with the environment. Anatomically, the nervous system is divided into Central and peripheral. Peripheral include: peripheral nerve nodes, trunks and endings.
The spinal nodes lie along the course of the posterior roots of the spinal cord. They are surrounded by a connective tissue capsule, from which partitions with blood vessels branch into the parenchyma. On the periphery of the organ there are bodies of receptor (sensitive) pseudo-bipolar neurons of a rounded shape. In the center - located processes of cells. Dendrites go to the periphery, and axons form the posterior roots of the spinal cord. The body of nerve cells surrounded by oligodendroglial (mantle cell) and further outwards from the glial connective tissue.
The spinal cord belongs to the organs of the Central nervous system. It distinguishes between gray and white matter. The grey matter forms the anterior (ventral), posterior (dorsal), and lateral (lateral) horns. Gray matter is represented by groups of cells, different in function, forming nuclei. There are: bundle cells (sensitive), internal cells (associative) and root cells (motor). Composed of gray and white substances, there are elements glial (lined by ependymal cells, astrocytes, oligodendroglial). In the posterior horns, there is a spongy layer, a gelatinous substance, a proper nucleus of the posterior horn, and a thoracic nucleus. The medial and lateral intermediate nuclei are located in the intermediate zone. In the anterior horns, there are medial and lateral groups of motor cells.
The autonomic nervous system regulates the activity of internal organs, blood and lymphatic vessels, and smooth muscles. It consists of Central (brain stem, middle and medulla oblongata, vegetative nuclei of the spinal cord) and peripheral (vegetative ganglia, preganglionic and postganglionic fibers) departments. According to functional features in the autonomic nervous system, there is a distinction between sympathetic and parasympathetic. The autonomic nervous system consists of Central parts (the core of the brain and spinal cord) and peripheral parts (nerve trunks, nerve nodes, and plexuses). The sympathetic group includes the vegetative nuclei of the lateral horns of the thoracic and upper lumbar spinal cord, the parasympathetic group includes the vegetative nuclei of the III, VII, IX, X pairs of cranial nerves and the vegetative nuclei of the sacral spinal cord. The peripheral nodes (ganglia) of the autonomic nervous system lie outside the organs (sympathetic paravertebral, prevertebral and parasympathetic nodes of the head) and in the wall of the organs as part of the intramural nerve plexuses. The vegetative ganglia are covered with connective tissue, layers of which penetrate the parenchyma. The organ consists of multipolar cells, diverse in shape and size. Intramural plexuses consist of three types of cells – long-axon efferent neurons (type 1 cells, type 1 Dogel cells), equidistant neurons (type 2 cells, type 2 Dogel cells), associative neurons (type 3 cells, type 3 Dogel cells).
Reflex - the response of the body in response to irritation. The nervous tissue is a part of the nervous system that functions according to the reflex principle, the morphological substrate of which is the reflex arc. The reflex arc is a chain of neurons connected by synapses and providing a nerve impulse. Reflex pathways are simple and complex, somatic and vegetative. The simplest reflex arc consists of two neurons - the sensory and motor. In most cases, insertion or Association neurons are included between the sensory and motor neurons.

VI.Learning activity.

1.On the micro-preparation "Spinal node" find and draw the node capsule (1), consisting of dense unformed connective tissue, under which are located pseudo-unipolar cells (2), a round shape with a vesicular nucleus (3). Each nerve cell is surrounded by a mantle layer of neuroglia (4). The Central part of the node is occupied by processes of nerve cells-nerve fibers (5) and layers of connective tissue (6).

2.Using the classroom tables, consider and draw the "Intramural ganglion" of the autonomic nervous system. It shows a connecting capsule (1) that penetrates the parenchyma of the node, forming its backbone (2). Nodes consist of: multipolar Dogel cells of the first type (3) - cells have many short dendrites and one long axon, Dogel cells of the second type (4) - equidistant, their processes leave the ganglion. The bodies of nerve cells and their processes are surrounded by neuroglia cells (5).

3.On the micro-product "Spinal cord" find and draw a white substance (I) located on the periphery; dark - in the shape of the letter H-gray matter (II) occupies the middle of the section. Both halves are connected by a commissure, in the center of which passes the spinal canal (1). In the gray matter, narrow dorsal horns (2) and broad ventral horns (3) are clearly distinguished. Between the ventral (anterior) horns lie the ventral ropes (4); between the ventral ropes and the dorsal horns lie the lateral ropes (5). Groups of cells in the anterior horns form the medial (6) and lateral (7) motor nuclei. In the middle part of the gray matter, a group of small cells forms a medial intermediate

nucleus (8), and laterally from it - a vegetative intermediate nucleus (9). Above the latter is the proper core of the dorsal horn (10). At the medial edge of the base of the dorsal horn is the nucleus of the Clare (11).

4. Draw and mark drawings:

5.Draw simple somatic arcs (2-neural and 3-neural)

6. Draw a vegetative reflex arc.

VII. Control question.
1.Organs of the Central and peripheral nervous system, the relationship between them.
2.Structure of the peripheral nerve, characteristics of the fibers that make up it.
3.Structure of the spinal (sensitive) ganglion, its neurocytes and gliocytes. The nature of the location of gliocytes in England.
4.The role and place of neurocytes of the spinal ganglia in the reflex arc.
5. The principle of organization of reflex arcs. Simple and complex somatic reflex pathways.
6.Structure of the Central and peripheral divisions of the autonomic nervous system.
7.Structure of the spinal cord. Neural and glial composition of gray and white matter.
8.Vegetative reflex arcs, their structural and functional differences from somatic ones.

VIII.Learning objective.
1.A pathoanatomic study of the human spinal cord revealed degeneration and a decrease in the number of cells that make up the nuclei of the anterior horns of the cervical and thoracic divisions. The function of which tissue was disrupted, primarily as a result of damage to the nuclei?
2.The disease poliomyelitis is accompanied by damage to the spinal cord and disorders of the musculoskeletal system. Destruction of neurons which is possible to explain this phenomenon? What link of the reflex arc is broken?
3.The patient has damaged the anterior roots of the spinal cord due to injury. The function of which organs will be disrupted? What changes are coming to them?
4.In the result of a viral infection killed pseudounipolar neurons of the spinal nodes. Which part of the reflex arc is switched off?
5.In the preparation of the anterior root of the spinal cord, nerve fibers are visible. Where are the bodies of the neurocytes whose processes form these fibers?
6.In the result of a viral infection killed pseudounipolar neurons of the spinal nodes. Which part of the reflex arc is switched off?
7.The task of the researcher is to study the motor neurocytes that Innervate the skeletal muscles of the extremities. Where are these neurocytes located? What kind of morphological type are they?

IX.The topics of structural abstracts.
1. Plasticity of the nervous system.
2. From neuron to brain.
3. Development of the autonomic nervous system in embryogenesis.

INDEPENDENT WORK

I. THE STUDENT SHOULD KNOW:

1. Histogenetically features of spinal and autonomic ganglia. 2. Structure of the Central and peripheral divisions of the autonomic nervous system. 3. Structure of the spinal cord. Neural and glial composition of gray and white matter. 4. Somatic and vegetative reflex arcs, their structural	1.Histology: textbook / edited by Yu. I. Afanasiev, N. A. Yurina. - 5th ed., pererab. and add. - M.: Medicine, 2006. 2.Histology: textbook / Under the editorship of E. G. Ulumbekova, J. A. Chelysheva. - 2nd ed., pererab. and add. - M.: GEOTAR-MED, 2009. 3. Methodological guide for students in histology. Part 1. L. A. Akoeva, L. A. gireeva, L. S. Tabolova, and others. Vladikavkaz, 2008.

and functional differences..	

II. THE STUDENT MUST BE ABLE TO:

1. At the microscopic level, determine the structural elements of the peripheral and Central organs of the nervous system.
2. Draw simple and complex reflex arcs.

III. Tasks to prepare for the lesson:
Task 1.Fill in the table « Spinal cord»

Horns of the spinal cord	Cellular composition	Kernels	Cell function	Glial cells

Task 2.Fill in the table « Nerve ganglia»

	The spinal ganglion	Autonomic ganglion
Localization		
Types and shape of cells		
Functional value of cells		

Direction of cell processes		
Elements of neuroglia		

Task 3. Add the missing information:
The Central divisions of the autonomic reflex arcs are located .....the spinal cord and brain stem, but only in certain areas. There are 2 types of vegetative nerve fibers:
…….. - suitable to the ganglia fibers (with axons of associative neurons), ...
In the vegetative ganglia (both sympathetic and parasympathetic), the mediator is ....., it transmits excitation from the preganglionic fiber to the effector neuron.
Mediators in the endings of postganglionic fibers are different:
for the parasympathetic system is re -.....,
and for the sympathetic - .....
The task №4.
The reflex is_____
_____
_____.
A simple reflex arc consists of _ _ _ neurons: _____ and
_____.
Task 4. Make 2-3 test tasks based on the sample.
The posterior roots of the spinal cord are formed:
a. axons of neurons in the spinal cord
b. dendrites of spinal ganglia neurocytes
c. axons of neurocytes in the lateral horns
d. axons of neurons of spinal nodes

V. self-monitoring Questions:
1.Organs of the Central and peripheral nervous system, the relationship between them.
2.Structure of the spinal (sensitive) ganglion, its neurocytes and gliocytes. The nature of the location of gliocytes in the ganglia.
3. Structure of the spinal cord. Neural and glial composition of gray and white matter.
4.Structure of the Central and peripheral divisions of the autonomic nervous system.\
5.Simple and complex somatic reflex pathways.
6.Vegetative reflex arcs, their structural and functional differences from somatic ones.

TEST YOURSELF:
CHOOSE ONE CORRECT ANSWER
1. What are the signs typical for the Dogel cells of type 2?
a. Short dendrites and a long axon.
b. Dendrites and axons of equal length.
c. Contain two cores.
d. Multipolar.

2. The centers of the sympathetic division of the autonomic nervous system are located in:
a. Brain stem.
b. Paravertebral ganglia.
c. Prevertebral ganglia.
d. In the lateral horns of the thoracolumbal spinal cord.

3. The autonomic nerve centers are located in the following structure of the spinal cord:
a. In the hind horns of the grey matter.
b. In the lateral horns of the gray matter.
c. Iin the anterior horns of the grey matter.
d. Iin white matter.
f. In the front spines.

4. The myelin-free nerve fiber contains:
a. Myelin sheath

b. Only one axial cylinder
c. Multiple axial cylinders
d. Interstitial segments

5. The anterior horns of the spinal cord contain:
a. Motor neurons.
b. Sensitive neurons.
c. Associative neurons.
d. Vegetative nuclei.

SELECT THE CONDITION UNDER WHICH THIS STATEMENT IS TRUE
6.The gray matter of the spinal cord contains glial cells:
a. Ependymocytes
b. Plasma astrocytes
c. Microgliosis
d. Oligodendroglial

7.The two-membered reflex arc, which closes at the level of the spinal cord segment, consists of:
a. Sensitive spinal ganglion neurocyte
b. Associative neurocyte of the lateral horn
c. Motor neurocyte of the anterior horn
d. Associative neurocyte intramural ganglion

8. Which of these cells are part of the vegetative ganglia?
a. Dogel Cells of type 1.
b. Dogel Cells of type 2.
c. Pseudounipolar neurocity.
d. Oligodendroglial.
f. Bipolar neurocytes.

9. Motor neurons of the autonomic nervous system are localized in:
a. Lateral horns of the spinal cord
b. Extramural ganglia
c. The dorsal root ganglia
d. Intramural ganglia

10. The anterior roots of the spinal cord are formed:
a. Axons of somatic motor neurons
b. Dendrites of sensitive neurons
c. Axons of autonomic neurons of the lateral horns of the spinal cord
d. Axons of sensitive neurons

TOPIC: THE NERVOUS SYSTEM. BRAIN.
PC-9

I. Motivational characteristics of the topic.
To understand the integrating and coordinating functions of the nervous system and, based on this, for proper diagnosis of diseases associated with disruption of the structure and functions of these bodies, you need to know: histophysiology nervous system; to learn that the nervous system is carried out according to the principle of the reflex arc, consisting of a chain of neurons, with special functional purpose (afferent, associative and efferent) are located in different parts of the nervous system.

II.Targets.
1. Have an idea of the reflex activity of the cerebral cortex and cerebellar cortex.
2. Be able to distinguish between layers and types of neurons, and know about the function of neurocytes located in these parts of the Central nervous system.
3. Have an idea of the hypothalamus as the highest vegetative center.

III.The required initial level of knowledge.
a) from the previous topics
1. Morphological and functional classification of neurocytes.

2. Types of nerve fibers.
3. Representation of the structure of complex reflex arcs.
4. Structural characteristics of the gray and white matter of the Central nervous system.

b) from the current session
1. The concept of cyto - and malariometric of the cerebral cortex.
2. The concept of granular and agranular type of the cerebral cortex.

3. Histophysiology of mossy and climbing nerve fibers and glomeruli of the cerebellum.

IV.Object of study.
a) micro-products for self-study.
1. The bark of the large hemispheres (colored with silver nitric acid)
2. Cerebellum (colored with silver nitric acid)

V. Information part.

The cortex of the brain is formed by a layer of gray matter. It is most strongly developed in the anterior Central gyrus. The cortex contains about 14 billion nerve cells and 10 times more neuroglial cells (astrocytes, oligldendroglyocytes, macrophages). Multipolar neurons of various shapes. Pyramidal (from small to giant components of ½ of all neurocytes) stellate, fusiform, arachnoid, bushy, etc.cells form the cytoarchitectonics of the cerebral cortex. There are 6 main layers of cells: I-molecular; II-external granular; III-pyramidal; IV-internal granular; V-ganglionic; VI-layer of polymorphic cells. The cortex is divided into: granular, forming a sensitive zone (well-developed granular layers-II, IV) and agranular, (forming motor areas – well-developed III, V, VI layers). The structural and functional unit of the neocortex is a module formed by a vertical column with a diameter of 300 microns. The module includes: cortical-cortical fiber, 2-a special afferent fibers, pyramid neurons, spiked stellate neurons (focal type and diffuse type), inhibitory neurons (cells with an axonal brush, basket neurons, axoaxonal neurons, cells with a double bouquet of dendrites).

Associative, commissural, and projection fibers, both afferent and efferent, form the myeloarchitectonics of the cerebral cortex. According to the location of the nerve fibers there are 6 layers:

1st layer – tangential; 2nd - bezmaterny; 3rd – nadolsky; 4th strip Bayarea; 5th – ganglionic; 6th – podolskoy. Among the fibers, the functions are distinguished: associative, commissural, and projection (two types – afferent and efferent).

The cerebellum is the Central organ of balance and coordination of movements. The surface area of the cerebellum increases significantly due to numerous furrows and convolutions. The main mass of gray matter in the cerebellum is located on the surface and forms its cortex. A smaller part of the gray matter lies deep in the white matter in the form of Central nuclei. In the center of each gyrus there is a thin layer of white matter, covered with a layer of gray matter-the cortex. Cells of the cerebellum cortex are mostly associative, only Purkinje cells are efferent. Neurons of the cerebellum cortex form three layers: molecular (basket and stellate cells); ganglionic (pear-shaped cells); granular (grain cells, large stellate cells, stellate neurons with long neurites, fusiform horizontal cells). Afferent information comes to the cerebellum via mossy and climbing fibers, connecting it to various parts of the brain and spinal cord. Neuroglia forms a backbone and consists of astrocytes, oligldendrogliocytes, macrophages, as well as – from specific elements-cells called "Bergman fibers".

VI.Learning activity.

1.In micropreparative "Cortex" find and sketch the following layers: molecular (1), located superficially just under the meninges and containing a small amount of associative cells; outer granular (2), composed of small stellate neurons and pyramidal form; a pyramidal layer (3) is the broad, represented large and medium-sized pyramids; internal granular (4), consists of small cells of stellate shape; ganglionic layer (5) formed giant pyramids of Betz located in one row; the layer of polymorphic cells (6) consists of cells of various shapes. Under the layer of gray matter that makes up the cortex of the large hemispheres, there is a layer of white matter (7) formed by bundles of myelin fibers and glial elements.

2.In the "Cerebellum" micropreparation, consider and draw the cerebellum gyrus (I), and in it - the white substance (II), which forms a thin layer in the center of each gyrus; III - the cerebellum cortex, which covers the white substance. In the cerebellum cortex are defined: the outer molecular layer (1), consisting of superficially located associative stellate cells (2) and lying closer to the middle layer of basket cells (3), which have short dendrites and long neurites that give off collaterals that form baskets on the bodies of pear-shaped cells. The middle-ganglionic

layer (4) is represented by large efferent pear-shaped neurons (Purkinje cells). From the upper pole of these cells, 2-3 dendrites branch off into the molecular layer, giving a branching parallel to the surface of the gyrus. The ganglionic layer is followed by a granular layer (5) rich in small associative neurons (grain cells, Golgi cells, etc.).

3. Draw and mark drawings:

VII.Control question.
1.General plan of the structure of the cortex of the large hemispheres.
2.Cytoarchitectonics and myeloarchitectonics of the cerebral cortex.
3.The General plan of the structure of the cerebellum, the functional value of the nerve cells of the cerebellum.
4.What is the neural organization of the cerebellum?

VIII.Learning objective.
1.Preparations for the brain of two dead people have been prepared for forensic research. In the area of the precentral gyrus of the cortex of the first of them, well-defined pyramidal layers were found. The second in the same area of the pyramid layers are weakly expressed. There are few neurocytes. Increased content of gliocytes. One of them suffered from paralysis of the limbs?
2.Alcohol intoxication is usually accompanied by impaired coordination of movement and balance, as a result of damage to the structural elements of the cerebellum. What cells of the cerebellum are violated in the first place?
3.It is known that the cerebellum performs the function of balance and coordination of movement. The Central link of the cerebellum is represented by pear-shaped cells, their dendrites have numerous synaptic connections, through which they receive information from proprioreceptors about the state of the motor apparatus and the position of the body in space. Name the associative cells that establish connections between pear-shaped cells.
4.In the patient, as a result of a brain hemorrhage in the left hemisphere, the function of 3.5 and 6 layers of gray matter in the cortex of the motor zone is blocked. Which pathways stop functioning? Which organs are affected and on which side of the body?
5.The micrograph shows a pyramidal cell about 120 microns in size, with neurite radiating from the base. Specify which area of the brain it belongs to, which pathways its axon is part of, where it can end in the spinal cord?

IX.The topics of structural abstracts.
1. Cortical neurons in the system organization of behavior.
2. From neuron to brain.
3. Neurons of the cerebral cortex in the system organization of behavior

INDEPENDENT WORK
I. THE STUDENT SHOULD KNOW:

1.The concept of CITO-and myeloarchitectonics of the cerebral cortex. 2.The concept of granular and agranular type of the cerebral cortex. 3.Histophysiology of mossy and climbing nerve fibers and glomeruli of the cerebellum.	1.Histology: textbook / edited by Yu. I. Afanasiev, N. A. Yurina. - 5th ed., pererab. and add. - M.: Medicine, 2006. 2.Histology: textbook / Under the editorship of E. G. Ulumbekova, J. A. Chelysheva. - 2nd ed., pererab. and add. - M.: GEOTAR-MED, 2009. 3. Methodological guide for students in histology. Part 1. L. A. Akoeva, L. A. gireeva, L. S. Tabolova, and others. Vladikavkaz, 2008.

II. THE STUDENT MUST BE ABLE TO:
At the microscopic level, determine the structural elements of the Central organs of the nervous system.

III. Tasks to prepare for the lesson:
Task 1.Fill in the tables: «Cortex of the major hemispheres»

layers.	The number and size of cells.	Cell shape.	Cell function

Distinguish 2 types of the cerebral cortex:.....- grainy layers are poorly expressed, located in the..... centers, ... the granular layers are developed especially strongly, located in the.....centers.

«Cortex of the cerebellum»

layer.	cells.	Contact of dendrites.	Axon contact .	Cell function
Molecular				
Ganglionic				
Granular				

Task 2. Add the missing information:
Between the cells of the cerebellum cortex there are strictly defined connections, and the cells themselves perform certain functions.
there are two main ways to pass a signal through the cortex :
I. the Shortest reflex arc
climbing fibers → pear-shaped cells → nuclei of the cerebellum
II. Over the long arc
Mossy plants fiber → granule cells → pear-shaped cell → nucleus of the cerebellum
mark the exciting signal (+) and the braking signal (-)

Task 3. Make 2-3 test tasks based on the sample.
In the cerebral cortex is dominated by:
a. Pear-shaped cells
b. Pyramid cells
c. Starry
d. Spherical
f. Polygonal

IV. Questions for self-monitoring:

1. Structure of the cerebral cortex. Types of bark.
2. Structure and role of the blood-brain barrier.
3. Reflex activity of the cerebral cortex.
4. Structure and role of the cerebellum.
5. Inhibitory and excitatory neurons of the cerebellar cortex.

TEST YOURSELF:
CHOOSE ONE CORRECT ANSWER
1. The granular type of crust is:
a. Cortex with a highly developed layer of polymorphic cells.
b Cortex with strongly developed outer and inner granular layers of cells.
c. Cortex with a well-developed pyramidal layer of cells.
d. Cortex with a well-developed molecular layer of cells.

2. Information from the cortex of the cerebellum is output:
a. Axons of stellate neurons of the molecular layer.
b. Axons of Purkinje pear-shaped neurons.
c. Climbing fibers.
d.Mos. fibers.
f.Axons of the cells of the beans.

3. What is the name of the inner layer of the cerebellum cortex?
a. Polymorphic.
b. Molecular.
c. Grainy.
d. Ganglionic.

4.Cells of the ganglion layer of the cerebellum cortex in shape:
a. Pyramid
b. Pear-Shaped
c. Polygonal
d. Cylindrical
f. Spherical

5. The cytoarchitectonics of the cerebral cortex is:
a.A natural arrangement of the cells of Betz.
b. Regular arrangement of nerve fibers.
c. Regular arrangement of cortical neurocytes.
d. The Natural location of the neuroglia.

SELECT THE CONDITION UNDER WHICH THIS STATEMENT IS TRUE
6. Afferent information enters the cerebellum by:
a. Mossy fibers.
b Axons of Purkinje cells.
c.In Climbing fibers.
d. Axons of grain cells.

7 The Cerebellum performs the following functions:
a.The Role of the center of the sympathetic nervous system.
b Role of the analyzer of all sensory information.
c.In the Coordination of movements.
d. Regulation of the balance of the body in space.

8. What layers are allocated in the cortex of the cerebellum?
a Molecular one.
b Pyramid.
c. In the Ganglionic.
d. Is Polymorphic.
f. Grainy.

9. The cerebellum performs the following functions:
a. The role of the center of the sympathetic nervous system.
b. The role of the analyzer of all sensory information.
c. Coordination of movements.
f. Regulation of the balance of the body in space.

10. "Baskets" around the Purkinje neurons of the pear-shaped form:
a. Climbing fibers.
b. The axons of the cells of the beans.
c. Dendrites of stellate cells of the molecular layer.
d. Axons of stellate cells of the molecular layer.
f. Axons of basket cells.

MODULE 2
Targets.
1. Show knowledge of theoretical material on the studied topics.
2. Be able to determine and differentiate histological structures of tissues in micro-preparations.
3. Solve situational problems and tests.

Control question:
1. Smooth muscle tissue in the preparation "bladder" (stained with hematoxylin-eosin).
2. Striated muscle tissue in the preparation "rabbit's Tongue "(color with iron hematoxylin).
3. Microscopic structure of neurocytes and sources of their development. Structure of neurons in various parts of the nervous system.
4. Morphological and functional classification of neurons.
5. Types of neuroglia, localization, structure, sources of development, functions.
6. Nerve fibers, their structure, localization, functional features.
7. Nerve endings, classification, structure.
8. The concept of interneuronal synapses.
9. Simple and complex somatic reflex pathways.
10. Organs of the Central and peripheral nervous system, the relationship between them.
11. Structure of the peripheral nerve, characteristics of the fibers that make up it.
12. Structure of the spinal (sensitive) ganglion, its neurocytes and gliocytes. The nature of the location of gliocytes in the ganglia.
13. The role and place of neurocytes of the spinal ganglia in the reflex arc.
14. Structure of the spinal cord. Neural and glial composition of gray and white matter.
15. Structure of the Central and peripheral divisions of the autonomic nervous system
16. Vegetative reflex arcs, their structural and functional differences from somatic arcs.
17. General plan of the structure of the cortex of the large hemispheres.
18. Cytoarchitectonics and myeloarchitectonics of the cerebral cortex.
19. The General plan of the structure of the cerebellum, the functional value of the nerve cells of the cerebellum.
20. What is the neural organization of the cerebellum?

Micropreparations
1.Smooth muscle tissue in the preparation "bladder" (stained with hematoxylin-eosin).
2.Striated muscle tissue in the preparation "rabbit's Tongue "(staining with iron hematoxylin).
3.Spinal cord (silver nitric acid staining)
4.Spinal node (hematoxylin-eosin stain)
5.Cerebellum (colored with silver nitric acid)
6.Cortex of the brain (silver nitric acid staining)
7.Myelin-free nerve fiber (hematoxylin-eosin stain)
8.Myelin nerve fiber (silver nitric acid staining)
9.Sensitive nerve endings of the Vater-Pacini body (hematoxylin-eosin stain)

Test task.

TOPIC: SENSORY ORGANS. ORGAN OF VISION.

PC-9

I. Motivational characteristics of the topic.

Knowledge of the structure and histophysiology of sensory organs is necessary for understanding not only normal function, but also for proper diagnosis and prevention of diseases of these organs.

All sense organs, or analyzers, provide perception (reception) of irritation from the external and internal environment of the body, the transformation of the energy of irritation into a nerve impulse and the conduct of impulses along the nerves to the centers of higher analysis (cortical-subcortical centers).

According to the peculiarities of structure, development and function, analyzers are divided into: 1) sensory organs, in which the primary sensory stimuli are nerve cells (the organ of vision and smell);

2) sensory organs, in which the primary perceiving stimulus are special cells (organs of hearing, balance, taste), from which the excitation is transmitted to the first afferent neuron (secondary - feeling cell).

II.Targets.

1. Learn the General plan of the analyzer structure, be able to identify peripheral analyzers, their receptor and auxiliary departments.

2. Have an idea about the features of primary and secondary - sensing cells, know the structural and cytochemical bases of reception.

III.The required initial level of knowledge.

a) from the previous topics:

1.Features of the structure and classification of epithelial tissue.

2.Constituent elements and functional value of connective tissue.

3.Histogenetically features of nerve cells and nerve fibers.

b) from the current session:

1.The performance of the analyzers.

2.Sources of development of structural components of the eyeball.

3.Sheath of the eyeball and their derivatives functional devices.

IV.Object of study.

a) micro-products for self-study:

1.Cornea of the eye (color hematoxylin-eosin).

2.The back wall of the eye (hematoxylin-eosin stain).

3.Retina in the dark and in the light (hematoxylin-eosin stain).

V. Information part.

The eye is the peripheral part of the visual analyzer. It consists of the eyeball and auxiliary apparatus (eyelids, lacrimal glands, oculomotor muscles).

The visual analyzer is a type of primary-feeling analyzer.

The eyeball is formed by three membranes: fibrous (sclera and cornea), vascular and internal (sensory) and their derivatives (iris, ciliary body) and a lens, liquid front and rear chambers of the eye vitreous body. In the eyeball, there are three main functional devices: dioptric or light-refractive (cornea, fluid of the anterior and posterior chambers of the eye, lens, vitreous body); accommodation apparatus (iris, ciliated body with ciliated belt); receptor apparatus (retina).

The retina and optic nerve are formed from the rudiments of the nervous system. The lens is from the ectoderm (originally a hollow epithelial vesicle). Vasculature and sclera - from the surrounding eye glass mesenchyma.

The sclera is a dense connective tissue shell. Its bundles of collagen fibres pass into its own substance of the cornea. At the junction of the sclera with the cornea, there are cavities – the venous sinus of the sclera (the helmet channel). The inner surface of the sclera in the area of contact with the iris forms the space of the iridocorneal angle, in which the comb ligament is located.

The vasculature consists of the vasculature proper, the ciliated body, and the iris.In the vascular membrane proper, there are: supravascular, vascular, vascular-capillary (choriocapillary), basal complex.

The cornea is formed by the following layers: anterior epithelium (multilayered flat non-corneal), anterior border plate (consisting of collagen fibrils and

the main amorphous substance), the corneal substance itself (thin connective tissue plates consisting of bundles of collagen fibers, fibroblasts, the main amorphous substance, there are no blood vessels), the posterior border plate (thin collagen fibers and the main amorphous substance), the posterior epithelium (single-layer flat epithelium).

The lens has the form of a biconvex body, its front wall consists of a single-layer flat epithelium. At the equator is the growth zone of the lens. New epithelial cells give crystalline fibers that have the protein kristalin in their composition. In the center, the fibers form the nucleus of the lens. Supports the lens of the ciliated band.

The iris consists of an anterior epithelium (single-layer flat), an outer border layer (connective tissue and pigment cells), a vascular layer (loose connective tissue and vessels), an inner border layer (similar to the outer one), and a posterior pigment epithelium (two-layer epithelium).

Ciliated body (ciliary body), derived from the vascular membrane. It performs the function of fixing and changing the curvature of the lens. It consists of two parts: the inner-ciliary crown; the outer-ciliary ring. From the surface of the ciliary corona, ciliary processes depart, to which the fibers of the ciliary girdle are attached. The main part of the ciliary body is formed by the ciliary muscle. The ciliary body and ciliary processes are covered by the ciliary part of the retina.

The receptor apparatus of the eye consists of three radially located neurons (photoreceptor, associative, ganglionic) and two that are included in radial chains (horizontal and amacrine). Radial gliocytes are located between radially directed neurons. Cells form several layers: photosenor (form the outer segments of rods and cones); outer boundary layer (form the peripheral processes of neuroglial cells); outer nuclear layer (the bodies of rods and cones); outer mesh layer (axons of sensory and dendrites of bipolar cells); the inner nuclear layer (bodies of associative, horizontal and bipolar cells); the inner mesh layer (axons of bipolar and dendrites of ganglionic cells); the ganglionic layer (bodies of ganglionic cells); the outer boundary layer (form peripheral processes of neuroglial cells).

VI.Learning activity.

1.In the micro-preparation "cornea of the eye" find and draw the anterior epithelium (1) - a multi-layer flat non-corneal, under which lies the anterior border membrane (2), the cornea's own substance (3) - a dense formed connective tissue that does not have blood vessels, the posterior border membrane (4), the posterior border epithelium (5) - a single-layer flat.

2.In the micro-preparation "Back wall of the eye", consider and draw the eye shells: sclera(I), vascular (II) and retinal (III).

The sclera is determined by the presence of collagen bundles (1) and fibroblast nuclei (2). The vascular membrane is characterized by a large number of pigment cells (3) and blood vessels (4) located in it. The lower, pigmented layer is the retinal pigment layer(5). This is followed by the photosensory layer (6) - the layer of cones and rods. Then there is a layer in which numerous nuclei are visible - the outer nuclear layer (7). Between it and the inner nuclear layer (8) is the outer mesh layer (9), and deeper than the inner nuclear layer is the inner mesh layer (10). Next to the inner retinal layer is the ganglion layer (11), which consists of large multipolar neurons. Then there is a layer of nerve fibers (12), on the inner surface of which lies the inner boundary layer (13). The outer boundary layer (14) is located between the rod and cone layer and the outer nuclear layer.

3.Examine the retina:

a) after the action of strong light on the eye. Retinal pigment epithelium with well-defined pigmented processes that extend between the rods and cones into the layer of rods and cones. Under the influence of bright light, the pigment moves from the bodies of pigment cells to their processes, protecting the photoreceptor cells from severe irritation.

b) after the effect on the eye of darkness. The processes of pigment epithelial cells are not visible due to the movement of pigment from them into the cell bodies. This creates optimal conditions for the functioning of photoreceptor cells in the dark.

4. Draw and mark drawings:

VII.Control question.

1.Classification of sense organs according to the genetic and morphological characteristics.

2.Embryonic sources of development of the main structural components of the eye.

3.The main shells of the eye, the features of their structure.

4.Characteristics of functional devices of the eye.

5.Neuronal composition of the retina, features of the ultramicroscopic structure of sensorineural cells.

VIII.Learning objective.

1.In the experiment, the animal was injured by the corneal epithelium. Is the regeneration process possible? If possible, at the expense of which cells?

2.A person has impaired twilight vision ("chicken blindness"). The function of which cells is impaired and what is the reason for this?

3.The patient sees well at close range and poorly at a distance. What structures of the eyeball can be associated with this condition?

4. During pregnancy, the woman long suffered from vitamin A. At birth it was discovered that the child is suffering from complete blindness. The administration of vitamin A to the child from the moment of birth led to the restoration of vision. What does this fact indicate?

IX. Abstract messages.

1.Origin of receptor cells.

2.Development and morpho-functional features of receptor cells of the visual organ in mammals.

3.Molecular and ultrastructural bases of reception.

4.Receptor evolution: cytological, membrane, and molecular levels.

5.Histophysiology of sensory systems (sense organs).

INDEPENDENT WORK

II. THE STUDENT SHOULD KNOW:

1.Classification of sense organs according to the genetic and morphological characteristics. The General plan of the structure of the analyzers. 2.The main membranes of the eye, the features of their structure. 4.Characteristics of functional devices of the eye. 5.Neuronal composition of the retina, features of the ultramicroscopic structure of sensorineural cells. 6.Auxiliary apparatus of the eye.	1.Histology: textbook / edited by Yu. I. Afanasiev, N. A. Yurina. - 5th ed., pererab. and add. - M.: Medicine, 2006. 2.Histology: textbook / Under the editorship of E. G. Ulumbekova, J. A. Chelysheva. - 2nd ed., pererab. and add. - M.: GEOTAR-MED, 2009. 3. Methodological guide for students in histology. Part 1. L. A. Akoeva, L. A. gireeva, L. S. Tabolova, and others. Vladikavkaz, 2008.

II. THE STUDENT MUST BE ABLE TO:

Determine the microscopic structures that form the cornea and back wall of the eye.

III. Tasks to prepare for the lesson:

Task 1. Continue your sentences.

1. The primary sense of the analyzer is…

2.The eye consists of the following shells:

1.

Two

3.

3.According to the function performed, the following parts of the eye are distinguished:

1.

2.

3.

4.The fibrous membrane is - …

5.Derivative of the fibrous shell -

6.The cornea is formed:

1.

2.

3.

4.

5.

7.Choroid – formed....., it performs the following functions.....

8.Derivatives of the vasculature:

1.

2.

9.The receptor apparatus of the eye is....

10.The light refractive apparatus of the eye is formed:

1.

2.

3.

4.

11.The eye's accommodation apparatus is formed:

1.

2.

The task 2. Fill in the table

The retina consists of 10 layers, each of which contains certain cells and their processes:

№	Name of the layer	Structures that form the layer
1.	pigment epithelium	
2.	layer of sticks and cones	
3.	The outer edge of the membrane	

4.	the outer nuclear layer	
5.	outer mesh layer	
6.	internal nuclear layer	
7.	inner mesh layer	
8.	ganglionic layer	
9.	layer of nerve fibers	
10.	The inner limiting membrane	

Task 3. Make 2-3 test tasks based on the sample.

The chain of transmission of electrical excitation in the retina:

(a) pigment cell→bipolar neuron→photoreceptor;

(b) photoreceptor→bipolar neuron→photoreceptor;

(C) photoreceptor→bipolar neuron→ganglion cell;

(d); pigment cell→ horizontal cell → bipolar neuron→photoreceptor;

(e) photoreceptor → horizontal cell → bipolar neuron → amacrine cell → ganglionic cell.

IV. Questions for self-monitoring:

1.Name the structures that form the light-refractive apparatus of the eye.

2.Name the structures that form the eye's accommodation apparatus.

3.Name the structures that form the iris.

4.Name three neurons that form the transmission of electrical excitation in the retina.

5.Features of the structure of the Central fossa and disk of the retina.

TEST YOURSELF:

CHOOSE ONE CORRECT ANSWER

1. Which cells in the sense organs are called primary-feeling cells?

a. Sessoamatoriale cells.

b. Neurocytes excited by epithelial cells.

c.into the Neurocytes of the sensitive nuclei of the brain.

d.Sensory cells.

2. What cells in the sense organs are called secondary-feeling cells?

a. Sessoamatoriale cells.

b. Neurocytes excited by epithelial cells.

c.into the Neurocytes of the sensitive nuclei of the brain.

d. Receptor nerve cells.

3. Why is the human retina called inverted?

a. the Image on it turns out to be inverted.

b. it absorbs all light.

the Photoreceptors are located deep in the retina, away from light.

d the Number of " sticks "is greater than the number of"cones".

4. In which layer of the retina are the horizontal neurons located?

and the Outer nuclear layer.

b Outer mesh layer.

c.into the Inner nuclear layer.

d. Inner mesh layer.

f.Ganglion layer.

5. In which layer of the retina are the amacrine neurons located?

a. the Outer nuclear layer.

b.Inner nuclear layer.

c.into the Inner mesh layer.

f.Ganglionic layer.

6. What is the structure of the" yellow spot " of the retina?

a. all the inner layers of the retina are Thinned and spread out in the path of light to the photoreceptor cells.

b. the axons of ganglion cells Converge.

c.the cones are Missing.

d. All layers of the retina are well developed.

7. What is the structure of the" blind spot " of the retina?

a. there are not enough Sticks, the cones become rod-shaped.

b. the axons of ganglion cells Converge, forming the optic nerve.

c.the cones Disappear.

d. All layers of the retina are well developed.

f. is Formed by a layer of nerve fibers.

8. Cornea:

a. the Outside is covered with a multi-layer flat non-corneal epithelium.

b.is covered with a single layer of epithelium on the Outside.

c.the Proper substance contains blood vessels.

f.Develops from the neural tube.

9. The outer segments of photoreceptor cells contain:

a. the Cilia.

b.Mitochondria.

c.into the Membrane disks.

f.Basal body.

10. The formation of the optic nerve involves:

a. Photoreceptor cells.

b. Bipolar neurons.

c.into the Ganglion cells.

d. Horizontal neurons

TOPIC: SENSORY ORGANS. ORGANS OF HEARING AND BALANCE.

PC-9

I. Motivational characteristics of the topic.

See the lesson on "organ of vision".

II.Targets.

1. Have an idea of the histogenetic features of secondary sensing receptor cells.

2. Study the morphofunctional features of the snail

3. To study the micro - and ultramicroscopic structure of the spiral organ and structural components of the vestibular apparatus.

III.The required initial level.

a) from the previous topics.

1. Features of the structure of epithelial tissue.

2. Constituent elements and functional value of connective tissue.

3. Histogenetically features of nerve cells and nerve fibers.

b) from the current session.

1. Representation of the classification of sense organs.

2. Morphological and functional characteristics of secondary sentient sense organs.

3. Structure of the membranous apparatus of the snail.

4. The structure of the receptor cells of the spiral organ.

5. Features of the organization of receptor cells of the organ of balance and gravity.

IV.Object of study.

a) micro-products for self-study.

1. Cortical organ (hematoxylin-eosin stain)

b) electronic messages.

No. 262, 268, 269.

V. Information part.

The structure of the organ of hearing and balance includes the outer, middle and inner ear. The inner ear is formed by a bony labyrinth and a membranous labyrinth located in it.

The receptor cells of the hearing organ are located in the spiral organ of the cochlea, and the balance organ - in the spots-macules of the saccules (sacculus and utriculus) and scallops - crystals of the ampullary part of the semicircular channels.

The balance organ consists of a spherical vesicle-SAC or sacculus, an elliptical vesicle of the uterus or utriculus, and three semicircular channels. At the junction of these channels with the uterus, extensions are formed-ampoules. The SAC connects to the canal of the snail. The ampoule contains receptor sites in the form of scallops or Crist. In the uterus and SAC, the receptor sites have the appearance of spots or macules. In these areas, the epithelium has a special structure, and the rest of the vestibular membranous labyrinth is lined with a single-layer flat epithelium. The macular epithelium consists of 7,000-9,000 sensory hair epithelial cells and supporting cells located between them. Over the surface of the epithelium is having a gelatinous consistency otolithic membrane containing calcium carbonate crystals (otoliths or statoconia). The otolith membrane is embedded with hairs of receptor cells that bend when the membrane is displaced. In this case, the hair cells are excited and transmit electrical impulses to the dendrites of bipolar neurocytes of the vestibular ganglion.

There are two types of hair cells:

* pear-shaped cells have a wide base and a narrow apical part. On the apical surface there is a cuticle with 60-80 fixed hairs-stereocilia. In addition, there is a mobile hair on the surface of the cells - a kinocilia, which is an eccentrically located cilia. At the base of each pear - shaped cell, a Cup-shaped nerve terminal is placed;

* cylindrical cells have a prismatic shape, and they end in the nerve endings of dendrites - bipolar cells of the point type. Otherwise, the structure of these cells is similar to that of the pear-shaped ones. Also in the macula there is a third type of cell-support cells, which have a prismatic shape and numerous microvilli on the apical surface. Its main function is holocrine secretion of otolith membrane components.

Maculae perceive the earth's gravity, linear acceleration. The sacculus is also responsible for vibrational perceptions. Scallops in ampoules of semicircular channels are fundamentally constructed in the same way as spots. They include receptor hair cells (cylindrical and pear-shaped) and support cells. The total number of hair cells is 15,000-17,000. Instead of an otolith membrane, a gelatinous substance is formed here in the form of a dome. The dome is a product of holocrine secretion of support cells, it does not contain otoliths, unlike the otolith membrane. The dome is filled with kinocilia and stereocilia. When the head moves and the body moves faster, the dome is deflected due to the movement of the endolymph in the semicircular channels. The main function of scallops is the perception of angular accelerations

The cochlear part of the inner ear is represented by the bone canal of the cochlea, inside of which there is a membranous canal. The membranous labyrinth repeats the course of the bony labyrinth. On the cross section, the membranous canal of the snail has a triangular shape. The upper medial wall of the membranous canal of the cochlea is called the Reisner, or vestibular, membrane; the lateral wall is represented by a vascular stripe; the lower wall is called the basilar membrane or spiral membrane.

The spiral membrane is represented by a connective tissue plate consisting of collagen fibers immersed in an amorphous matrix. Collagen fibers consist of thin fibrils and play the role of strings. Short strings located at the base of the cochlea respond to high sounds, long strings located at the top respond to low sounds.

On the inner surface of the basement membrane is a spiral (cortical) organ. It includes internal and external hair (sensoepithelial) cells that support internal and external cells and column internal and external cells that belong to the group of supporting cells. Internal and external column cells limit the tunnel filled with endolymph. The cells of the spiral organ located between the tunnel and the vascular strip are called external, and between the tunnel and the limb – internal. Internal hair cells are arranged in a single row, have a pear-shaped shape, and lie on the internal supporting cells. There are about 60 fixed cilia (stereocilia) on the apical surface. The outer hair cells are arranged in 3-5 rows, prismatic in shape, and lie on the outer supporting cells. On the apical surface there are cilia (hairs), which contain holinoreceptor proteins and the enzyme acetylcholinesterase. The cover membrane is a connective tissue plate consisting of radially directed collagen fibers embedded in an amorphous matrix. The inner edge of the membrane is attached to the spiral comb, the outer edge freely hangs over the spiral organ throughout its entire length. When the spiral organ vibrates, the hairs (stereocilia) of the hair cells touch the covering membrane, which contributes to the appearance of a sound pulse. Sound effects on the eardrum are transmitted to the hammer, anvil, and stirrup, and then through the oval window to the perilymph, basilar and tectorial membranes. This movement strictly corresponds to the frequency and intensity of sounds and is associated with a certain level of the cochlear canal. In this case, there is a deviation of stereocilia and excitation of receptor cells. It is accompanied by interaction of acetylcholine with the endolymph holinoretseptoram protein membrane stereocilia. This leads to the emergence of a receptor potential.

VI.Learning activity.

1.Find and draw the following structures in the preparation "Kortiev organ": three to five whorls of the bone snail (1) around the bone rod of the snail (2). Inside each whorl of the snail, a triangular-shaped membranous canal (3) can be found. Its base is the basilar membrane (4), under which the drum ladder (5) is located; the outer wall is a vascular strip (6), adjacent to the outer wall of the bone snail (7); the inner upper wall is the vestibular ladder (8). The vascular strip is located on the spiral ligament (9). On the basilar membrane, attached from the inside to the spiral bone plate (10), there is a hearing organ - a spiral, or cortical organ (11). The periosteum of the spiral bony plate forms a thickening-limb (12), in which the upper vestibular lip (13) and the lower tympanic lip (13) are distinguished. At the base of the spiral bone plate lies a cluster of bipolar afferent neurons-the spiral ganglion (15). The spiral organ consists of two types of cells - support and receptor. Among the support cells that touch the basement membrane, internal (16) and external column cells (17) are distinguished, as well as internal (18) and external (19) supporting cells. The column cells form a triangular channel - tunnel (20). Outside of them, the external supporting cells are visible (16). Internal (21) and external (22) hair sensory epithelial cells lie on supporting cells: internal - in one row, external - in three or four rows. Over the spiral organ hangs a covering plate (23), which has a connection with the epithelium of the vestibular lip of the limb.

2. Draw and mark drawings:

VII.Control question.

1. Sources of development of the organ of hearing and balance.

1. Structure of the outer and middle ear.

2. Structure of the vestibular apparatus of the inner ear, morphofunctional characteristics of sacs and ampoules.

3. Name and describe the walls of the membranous labyrinth of the snail, their functional significance.

4. The structure of the spiral (Korteweg) of the body, morphological and functional properties of sensory and supporting cells.

VIII.Learning objective.

1.Patients who take large doses of antibiotics, Quinine, and other medications often experience hearing loss. What cells are not functioning properly? Which part of the analyzer is broken?

2.A person has a disturbed perception of irritation associated with the position of the body in relation to the gravitational field. Loss of function of which receptor cells can be assumed?

3.Can a person in a state of weightlessness navigate in space? If "Yes", then with what sense organs?

4.The spiral ganglion is completely affected by the pathological process. What functional changes will be detected?

IX.The topics of structural abstracts.

1. The receptor of gravity.

2. Cytological and molecular bases of reception.

3. The receptor of gravity.

4. The organ of Corti. Histophysiology and histochemistry

INDEPENDENT WORK

II. THE STUDENT SHOULD KNOW:

1.Classification of sense organs according to the genetic and morphological characteristics. The General plan of the structure of the analyzers. 2. Organ of hearing. Features of its structure. Snail, microscopic structure. The membranous canal of the cochlea (cochlear canal). 3. Spiral (cortical) organ.	1.Histology: textbook / edited by Yu. I. Afanasiev, N. A. Yurina. - 5th ed., pererab. and add. - M.: Medicine, 2006. 2.Histology: textbook / Under the editorship of E. G. Ulumbekova, J. A. Chelysheva. - 2nd ed., pererab. and add. - M.: GEOTAR-MED, 2009. 3. Methodological guide for students in histology.

4. Vestibular part of the membranous labyrinth. Spots of sacs (macula). Ampullary scallops (Krists)	Part 1. L. A. Akoeva, L. A. gireeva, L. S. Tabolova, and others. Vladikavkaz, 2008.

II. THE STUDENT MUST BE ABLE TO:

Determine bone formations and their derivatives; inside the cochlea canal – three of its parts (the tympanic staircase, the membranous canal of the snail, the vestibular staircase; the spiral (cortical organ).

III. Tasks to prepare for the lesson:

Task # 1. Continue your sentences.

1. Continue the sentence " Secondary sensing analyzer is…

2.The ear consists of the following parts:

1.

Two

3.

3.The outer ear is formed

1.

2.

4.The border between the outer and middle ear -

5.The eardrum consists of -

6.The middle ear consists of:

1.

2.

3.

7.The bone snail forms in humans.....

8.The sides of the cochlear canal form:

1.

2.

3.

9.The spiral organ is....

10.Outer sessoamatoriale cells have the following characteristics and are located …

11.The vestibular part of the membranous labyrinth is.....

12.Ampullary scallops – Krists) are

The task № 2. Fill in the tables:

Table 1. First, insert the missing words in the second column, and then, in the 1st column, the name of the part of the vestibular apparatus, the description of which is given in the second column

	The receptors are contained in the epithelial spot, or..... , and they respond to gravitational forces.
	In this case, there is a gelatinous membrane over the sensitive cells of the spot, which, depending on the gravitational attraction, moves in one direction or another, which leads to irritation of the cells.
	Sensoepithelial cells also form a receptor....., covered with a gelatinous membrane, but react not only to gravity, but also to vibration (namely, to vibrational vibrations of the gelatinous membrane).

Table 2

Spiral (cortical) organ (in the membranous cochlea)	Perception ……
Elliptical SAC spot	Perception ……
Spot of spherical SAC	Perception ……..…and……
Ampoules of semicircular channels	Perception ……. when the head and body rotate

Task 4. Make 2-3 test tasks based on the sample.

The organ of Corti has:

(a) stereocilia;

(b) cinalli;

(c) otolith membrane;

(d) cover membrane;

(e) supporting cells.

IV. Questions for self-monitoring:

1.Name the structures that form the sound-conducting part of the ear and their structure.

2.Name the structures that form the sound-receiving part of the ear and their structure.

3.Name the structures that form the vestibular part of the inner ear and their structure.

TEST YOURSELF:

1. In what formation of the inner ear is the spiral organ located?

a. Drum ladder.

b. Vestibular staircase.

c. into the Membranous canal of the snail.

d. Utriculus.

f. Sacculus

2.What is the limit of the membranous canal of the snail?

a. the Vestibular membrane.

b. basilar membrane.

c. in a Spiral ligament with a vascular strip.

d. the eardrum.

3. What formed the tunnel of the spiral organ?

a. Supporting the Outer lashes.

b. Cells of pillars.

c. In the Internal phalangeal cells.

d. Sessoamatoriale cells.

4. Where is the spiral (Cortical) organ located?

a. on the threshold of the snail.

b. In the spherical mamochke.

c. In the membranous canal of the snail.

d. In the semicircular canals.

5. What is the tunnel of the spiral organ?

a. Blood vessels.

b. Processes of neurons of the spiral ganglion.

c.into the Collagen fibers (strings).

6. Where are the auditory spots located?

a. in the cochlea.

b. in semicircular tubules.

c. in the bags of the threshold.

d. in the middle ear.

7. What is the hammer handle attached to?

a. To the outer surface of the eardrum.

b. To the inner surface of the tympanic membrane.

c. To the oval window.

f. To the round window.

8. The sound conducting apparatus of the hearing organ includes:

a. The Eardrum

b. The Auditory ossicles

c.In the Membrane of the oval window

f.Perilymph of the vestibular staircase of the snail

9. The basilar plate of the membranous canal of the snail contains:

a. The Basal membrane

b Thin collagen fibers

c. Into the Endothelium

d. Cover membrane

10. Ampullary scallops of the vestibular Department consists of:

a Supporting cells

b Gelatinous dome

c.In Sessoamatoriale cells

d. Otolith membrane

TOPIC: CARDIOVASCULAR SYSTEM.
PC-9

I. Motivational characteristics of the topic.
The cardiovascular system performs such important functions in the body as conducting and distributing blood in organs, regulating blood filling, metabolism between blood, tissues, etc.when the structure and function of different parts of the cardiovascular system are violated, severe diseases occur: heart defects, myocardial infarction, atherosclerosis, hypertension, etc. All this makes it necessary to study the cardiovascular system in detail for a future doctor of any profile.
II.Targets.
1. Understand the General principle of interdependence of the structure of the vessel wall and hemodynamic conditions.
2. Know the tissue composition of the walls of arteries and veins.
3. Have an idea about the vessels of the microcirculatory bed.

III.The required initial level of knowledge.

a) from the previous topics:
1.Structure and functional features of smooth muscle tissue.
2.Structure of loose fibrous connective tissue.
b) from the current session:
1.Embryonic source of vascular development.
2.General plan of the structure of the wall of arteries and veins, their classification and microscopic structure.
3.Representation of the microcirculatory bed. The main types of blood capillaries and their microscopic structure.
4.Classification of arteriolo-venular anastomoses.
5. Structure and localization of elastic type vessels.
6. Heart shells and their tissue composition, structure of heart valves. Age-related structural features of the heart.
IV.Object of study.
a) micro-products for self-study
1. Muscle-type artery (hematoxylin-eosin stain)
2. Muscle-type vein (hematoxylin-eosin stain)
3. Vessels of the microcirculatory bed (hematoxylin-eosin staining)

b) electronic messages
No. 280, 281, 299.

V. Information part.
The cardiovascular system is a set of organs (heart, blood and lymphatic vessels) that ensure the distribution of blood and lymph throughout the body, containing nutrients and biologically active substances, gases, and metabolic products. Blood vessels are a system of closed tubes of various diameters that perform transport functions, regulate blood supply to organs, and exchange substances between blood and surrounding tissues. In the circulatory system, there are arteries, arterioles, hemocapillaries, venules, veins, and arteriovenous anastomoses. The relationship between arteries and veins is carried out by the system of vessels of the microcirculatory bed. Blood flows through the arteries from the heart to the organs. This blood is oxygenated, with the exception of the pulmonary artery, which carries venous blood. Blood flows through the veins to the heart and contains little oxygen, but a lot of nutrients. Hemocapillaries connect the arterial link of the circulatory system with the venous, except for the so-called miracle networks, in which the capillaries are located between the same vessels. The thickness, tissue composition and functional features are not the same in different types of vessels.
Arteries. According to the structure of the artery there are three types: elastic, muscular and mixed. The artery wall consists of three layers: inner, middle and outer.
Most of the body's arteries are muscle-type arteries. These include mainly medium-and small-sized vessels, i.e. arteries of the body, limbs, and internal organs. The walls of these arteries have a relatively large number of smooth muscle cells, which provides additional pumping force and regulates blood flow to the organs. The inner shell consists of the endothelium, the subendothelial layer, and the inner elastic membrane. Endothelial cells are elongated along the longitudinal axis of the vessel. The subendothelial layer consists of thin elastic and collagen fibers, as well as poorly specialized connective tissue cells and smooth myocytes. To the outside of the subendothelial layer, there is a closely related internal elastic membrane (a plexus of elastic fibers). The middle shell is formed by smooth muscle cells arranged in a gentle spiral, between which there are a small number of connective tissue cells and fibers. Smooth muscle cells by their contractions maintain blood pressure, regulate blood flow to the vessels of the microcirculatory system of organs. Collagen fibers form a supporting framework for smooth myocytes. Elastic fibers merge with elastic membranes, creating a single elastic framework that gives the vessel elasticity when stretched and elasticity when compressed. The elastic framework prevents the decline of the arteries, which causes their constant gaping and continuity of blood flow. The outer elastic membrane is located on the border between the middle and outer shell. The outer shell consists of loose fibrous connective tissue, in which nerves and blood vessels that feed the wall constantly meet.
Elastic type arteries are characterized by a pronounced development of elastic structures in the middle shell. These include large-caliber vessels - the aorta and pulmonary artery, in which blood flows at a high speed (0.5-1.3 m/s) and at a high (120-130 mm Hg. art.) pressure. Large-caliber arteries perform mainly a transport function. The presence of a large number of elastic elements allows these vessels to stretch during systole and return to their original position during diastole. The inner shell includes the endothelium, the subendothelial layer, and the plexus of elastic fibers. The endothelium consists of cells of various shapes and sizes located on the basement membrane. Most often they are single-core, the cytoplasm has a poorly developed endoplasmic network of granular type. There are a large number of mitochondria, and microfilaments that form the cytoskeleton are very numerous. The subendothelial layer consists of loose, fine-fibrillar connective tissue rich in stellate cells. These cells support the endothelium. Deeper than this layer is a thick plexus of elastic fibers corresponding to the inner elastic membrane. The middle shell consists of a large number of elastic finned membranes connected by elastic fibers and forming a single elastic framework together with the elastic elements of other shells. Between the membranes lie obliquely arranged smooth muscle cells. The outer shell is constructed of loose fibrous connective tissue with a large number of collagen and elastic fibers that protect the vessel from overgrowth and breaks. The outer shell also contains feeding vessels and nerve trunks.

Mixed-type arteries (muscle-elastic) are larger in caliber than the previous ones and occupy an intermediate position between muscle-type and elastic-type vessels. These include the carotid and subclavian arteries. The inner shell consists of an endothelium, a subendothelial layer, and an internal elastic membrane. The middle shell contains an equal number of smooth myocytes and connective tissue elements. A small amount of collagen fibers and fibroblasts is found between smooth muscle cells and elastic elements. The outer shell has vascular vessels and nerve fibers.
The venous system makes up the diverting link of blood. The veins are similar in General plan to the arteries. In the veins, there are three shells: internal, middle and external, in the veins there are no internal and external elastic membranes. The structure of veins is closely related to the hemodynamic conditions of their functioning. Low blood pressure (15-20 mm Hg St.) and the insignificant speed of blood flow determine the relatively weak development of elastic elements in the veins and their greater extensibility. The number of smooth muscle cells in the vein wall varies and depends on whether the blood moves to the heart under the influence of gravity or against it. The need to overcome the gravity of the blood in the veins of the lower extremities leads to a strong development of smooth muscle elements. According to the degree of development of muscle elements in the vein wall, they can be divided into two groups: muscle-free (fibrous) type veins and muscle-type veins. Veins of the fibrous type differ in the thinness of the walls and the absence of a middle shell, which is why they are called muscle-less veins. These include the veins of the Dura and soft meninges, the veins of the retina, the bones of the spleen and placenta. The veins of the meninges and retina of the eye are strongly stretched, and the blood in them under the influence of gravity, easily flows into the larger venous trunks. The veins of the bones, spleen and placenta are firmly fused with the dense elements of the corresponding organs and do not fall off. The wall of such veins is represented by an endothelium surrounded by a layer of connective tissue.
Veins of the muscular type are in turn divided into veins with weak development of muscle elements, veins with medium and strong development of muscle elements. Many veins have valves that are derived from the inner lining. Valves promote the flow of venous blood to the heart, preventing its reverse movement.
Veins with weak development of muscle elements – small and medium veins of the upper body, as well as large veins, such as the superior Vena cava. The walls of such veins are thinner in the caliber of the corresponding arteries. In their wall, the subendothelial layer is poorly developed, with a small number of smooth muscle cells lying in groups in the middle shell. In the outer shell, there are single longitudinally directed smooth muscle cells.
Veins with average development of muscle elements – medium-sized veins, (shoulder vein). The inner shell forms a valvular apparatus, formations in the form of pockets, the free edges of which are directed to the heart. The middle shell consists of circularly arranged bundles of smooth myocytes separated by layers of loose fibrous connective tissue. The outer shell is strongly developed, its size is 2-3 times larger than the size of the middle shell. The collagen and elastic fibers of this shell are directed longitudinally, and individual smooth muscle cells are also located longitudinally.
Veins with a strong development of muscle elements – large veins of the lower half of the trunk and legs (for example, the femoral and inferior Vena cava). They are characterized by the development of bundles of smooth muscle cells in all three shells, and in the inner and outer they have a longitudinal direction, and in the middle – circular. The inner shell forms valves and consists of the endothelium, a subendothelial layer formed by loose fibrous connective tissue, in which bundles of smooth muscle cells lie longitudinally. There is no internal elastic membrane, but clusters of elastic fibers are visible. The middle shell contains smooth muscle cells surrounded by collagen and elastic fibers. In the outer shell formed by loose fibrous connective tissue, bundles of longitudinally arranged smooth myocytes, vascular vessels and nerve fibers are found.
The microcirculatory bed is a complex of blood vessels surrounded by lymphatic vessels that regulates blood supply to organs, exchange at the tissue level, and tissue homeostasis. The microcirculatory bed includes three links: arterial (arterioles precapillaries); capillary; venous (postcapillaries, collective and muscle venules).

Functions of the microcirculatory bed:
* trophic and respiratory functions-the exchange surface of capillaries and venules is 1000 m2, or 1.5 m2 per 100 g of tissue;
* depositing function - in the vessels of the microcirculatory bed at rest, a significant part of the blood is deposited, which during physical work is included in the blood flow;
• the drainage function of the microcirculation collects blood from the arteries and bringing it distributes in the body;
* regulation of blood flow in the organ, this function is performed by arterioles due to the presence of sphincters in them;
• transport function.

Arterioles – microvessels connected, on the one hand, with arteries, and on the other hand gradually pass into capillaries. Arterioles have a diameter of 50-100 microns, their structure preserves three shells, but they are less pronounced than in the arteries. The inner shell consists of endothelial cells, a thin subdothelial layer, and a thin internal elastic membrane. The middle shell is formed by 1-2 layers of smooth muscle cells that have a spiral direction, in the precapillaries, smooth muscle cells are located singly. In arterioles, perforations are found in the basement membrane of the endothelium, thanks to which endotheliocytes and smooth muscle cells contact, which create conditions for the transmission of information. A small amount of elastic fibers is found between the muscle

cells. There is no external elastic membrane. The outer shell is represented by loose fibrous connective tissue. In the area of departure from the capillary arteriole, there is a smooth muscle sphincter that regulates blood flow. This area is called the precapillary.
The structure of capillaries shows a layered principle. In their wall, three thin shells are distinguished, represented by cells. The inner layer is formed by the endothelium. The endothelial layer of the capillary is an analog of the inner shell. It lies on the basement membrane–a thin-fibrillar, porous, semi-permeable plate with a thickness of 30-35 nm, which consists of collagen, glycoproteins, fibronectin, and proteoglycans. which first splits into two leaves, and then joins. The result is a cavity in which lie the cells of the connective tissue pericytes, These cells have a process form and the form of a basket surrounded by blood vessels.. These cells end with vegetative nerve endings, under the regulating action of which cells can accumulate water, increase in size and close the lumen of the capillary. When water is removed from the cells, they decrease in size, and the lumen of the capillaries opens. Functions of pericytes: changing the lumen of capillaries; source of smooth muscle cells; control of endothelial cell proliferation during capillary regeneration; synthesis of basement membrane components; phagocytic function. The basal membrane with pericytes is an analog of the middle shell. Outside of it is a thin layer of the main substance with adventitial cells that play the role of cambium for loose fibrous unformed connective tissue.
The outer layer has adventitial cells – these are poorly differentiated cells located outside of the pericytes. They are the cambial precursors of fibroblasts, osteoblasts, and adipocytes. There are three types of capillaries: somatic-capillaries with a solid endothelial lining and a basement membrane. They are found in the heart and skeletal muscles, in the lungs, CNS and other organs; fenestrated– capillaries with pores in endotheliocytes, tightened by the diaphragm (fenestrae). They are found in the endocrine organs, in the own plate of the mucous membrane of the small intestine, in brown adipose tissue, in the kidney; capillaries of a perforated type with through holes in the endothelium and basement membrane. They are characteristic of the hematopoietic organs, the liver. The diverting Department of the microcirculatory bed begins with the venous part of the capillaries. The diameter of the venous capillary can be 1.5-2 times wider than the arterial one. There are three types of venules: postcapillary, collective and muscular. Postcapillary venules in their structure resemble the venous part of the capillary but a larger diameter (12-30 microns) and a large number of pericytes.. In the collective venules (diameter 30-50 microns), which are formed when several postcapillary venules merge, there are already two distinct shells: the inner (endothelial and subendothelial layers) and the outer - loose fibrous unformed connective tissue. Muscle venules have one or two layers of smooth muscle cells and a relatively well-developed outer shell. In diameter, there are narrow (diameter-from 4.5 to 6-7mkm), medium diameter (7-11 microns), wide (20-30MKM) – sinusoid, with an interrupted basement membrane of the sinusoid type. Arteriolo-venular anastomoses or shunts are a type of vessels of the microcirculatory bed, through which blood from the arterioles enters the venules, bypassing the capillaries. Arteriolovenulyarnye anastomoses are: true and atypical. According to the structure, there are: a) simple ABA; b) atypical ABA
The heart is the main organ that drives the blood. In the heart wall there are three shells: an inner - endocardium, mid - myocardium, outer - epicardium.
Endocardium-lines the heart chambers, muscle papillae and tendon filaments, and heart valves from the inside. The surface of the endocardium facing the heart cavity is lined with endothelium, consisting of polygonal cells lying on a thick basement membrane. It is followed by a subendothelial layer formed by connective tissue rich in poorly differentiated connective tissue cells. Deeper is the muscle-elastic layer, in which elastic fibers intertwine with smooth muscle cells. The deepest layer of the endocardium – the external connective tissue-lies on the border with the myocardium. It consists of connective tissue containing thick elastic, collagen and reticular fibers. The endocardium forms duplicates-heart valves-dense plates of fibrous connective tissue with a small content of cells covered with endothelium. The atrial side of the valve is smooth, while the ventricular side is uneven and has outgrowths.
The myocardium - the muscle membrane of the heart-is formed by striated muscle cells that, when in contact with each other, form functional muscle fibers. There are typical contractile muscle cells, atypical cardiac myocytes that are part of the conducting system of the heart and secretory (endocrine) muscle cells. The main mass of the myocardium is made up of working (typical) cardiomyocytes. They have a rectangular shape, contain 1-2 nuclei in the Central part and myofibrils on the periphery. Numerous mitochondria are located between the myofibrils. The cells are covered with a sarcolemma consisting of a plasmolemma and a basement membrane, into which collagen and elastic fibers are intertwined, forming the "outer skeleton" of cardiomyocytes. The basal membrane, which contains a large number of glycoproteins and is able to bind CA+ ions, can participate along with the sacroplasmic network and mitochondria in the redistribution of CA+ in the contraction-relaxation cycle. The basal membrane has invaginations in the tubules of the T-system. Cardiomyocytes communicate with each other in the area of insert disks, which have the form of dark stripes. Insert disks are places where the cytolemma contacts neighboring cardiomyocytes, including desmosomes, places where myofibrils interweave into the plasmolemma (intermediate contacts) and slotted contacts – nexuses. If the first two sections perform a mechanical function, the third performs an electrical connection of cardiomyocytes. Nexuses provide metabolic (primarily ion) communication of cardiomyocytes. In functional terms, atypical muscle tissue is characterized by the ability to induce biopotentials in nodes, conduct impulses along the fibers of the conducting system and transmit them to contractile myocardiocytes. The conducting system of the heart includes the sinus-atrial node, atrioventricular node (sinus and atrioventricular node cells), atrioventricular bundle of GIS (right and left legs), cardiomyocytes from the bundle legs (Purkinje

fibers) that transmit impulses to contractile muscle cells. There are three types of conducting cardiomyocytes, which are located in different proportions in different parts of this system. Pulse formation occurs in the sinus node, the Central part of which is occupied by cells of the first type-rhythm drivers, or pacemaker cells (P-cells), capable of spontaneous contractions. They differ in small size, polygonal shape, a small number of myofibrils that do not have an ordered orientation. The atrioventricular node contains transitional cells. These are thin, elongated cells, myofibrils in them are more developed, there are short T-tubes. The functional significance of these cells consists in the transfer of excitation from the P-cells to the bundle cells and the working myocardium. The cells of the conducting system bundle (GIS bundle) and its legs (Purkinje fibers) make up the third type. In functional terms, they are the transmitters of excitation from the transition cells to the cells of the working ventricular myocardium. Purkinje cells are the largest cells not only in the conducting system, but also in the entire myocardium. They contain a lot of glycogen, a rare network of myofibrils, and no T-tubes. Cells are linked by nexuses and desmosomes. Secretory cardiomyocytes are located in the Atria. These are cells of a process form, with a poorly developed contractile apparatus and a significantly developed synthetic apparatus. The cytoplasm contains dense granules containing the hormone-atrial natriuretic factor-PF. Once in the blood, PF is brought to the target organs-kidneys, adrenal glands, brain, etc.PF causes stimulation of diuresis, natriuresis, vasodilation, inhibition of aldosterone, cortisol, vasopressin secretion, and a decrease in blood PRESSURE.
The epicardium and pericardium - the outer shell of the heart, is a visceral leaf of the pericardium, similar in structure to the serous membranes. The epicardium is formed by a thin layer of connective tissue that tightly fuses with the myocardium. Its free surface is covered with mesothelium. In the connective tissue base of the epicardium, there is a surface layer of collagen fibers, a layer of elastic fibers, a deep layer of collagen fibers and a deep collagen-elastic layer. In the parietal leaf of the pericardium, the connective tissue base is more developed than in the epicardium.

VI.Learning activity.

1.Find and draw three distinct vessel shells on the micro-product "muscle-type Artery". The inner shell (I) is formed by the endothelium (1) lining the vessel from the inside, which in the section has the appearance of a thin line with nuclei protruding into the lumen. Behind the endothelium is the subendothelial layer (2). The next layer is an internal elastic membrane (3) formed by a plexus of elastic fibers. The thickest middle shell (II) consists of circularly arranged smooth muscles (4). In larger arteries of this type, the middle membrane is separated from the outer by an elastic membrane (5). The outer shell (III) is formed by loose connective tissue, in which pass the vessels of the vessels (6) that feed the outer layers of the vessel wall.

2.On micropreparative "vein of muscular type" find and sketch the vein wall, but here the distinction between three shell to hold is difficult because the connective tissue, the basis of the whole wall moves from one shell to another, uniting them into one; also in veins no elastic membranes. In the inner shell (I), the endothelium(1) is well isolated. In places, you can distinguish a very thin subendothelial layer (2). Without a sharp border, the inner shell passes into the middle shell (II), which consists mainly of smooth muscle cells (3) lying in circular bundles. The outer adventitial sheath (III) is a loose connective tissue.

3.On the micro-product "Vessels of the microcirculatory bed" find capillaries (I), in the wall of which are visible longitudinally arranged nuclei of endotheliocytes (1) and more elongated nuclei of pericytes (2). Somewhat to the outside of them, also longitudinally lie the nuclei of adventitious cells (3). Arterioles (II) and venules (III) can be distinguished by the character of the striation of their walls, due to the circular arrangement of smooth muscles (4).

4.On the micro-preparation "Aorta" find three shells: internal (I), middle (II), external (III). In the inner shell, clearly visible sections of the longitudinal plexus of elastic fibers (1), cut mainly across. In the middle shell, dark-colored elastic end membranes (2) stand out sharply, and between them light layers of smooth muscles (3).

5.On the micro-product "heart Wall" find and draw the heart shells: endocardium (I), myocardium (II), epicardium (III). The following layers are defined in the endocardium: endothelial (1), subendothelial (2), muscle-elastic (3), and external connective tissue layer (4). The main mass of the heart wall is the myocardium, represented by cells-contractile cardiomyocytes (5), which have rounded nuclei (6) in the center of the cell. In the heart muscle, insert plates (7) and anastamoses (8) are isolated. Between the crossbars of the myocardium are connective tissue layers (9), with capillaries passing through it (10). Between the contractile muscle fibers and the endocardium are Purkinje fibers (11) with a lighter cytoplasm and eccentrically arranged nuclei.

6.Mark the drawings.

VII. Control question.

1.Sources of development and components of the cardiovascular system, the functional significance of its various departments.
2.Arteries, General plan of structure, classification.
3.Veins, General plan of structure, classification.
4.Vessels of the microcirculatory bed, structural features.
5.The lining of the heart and their tissue composition.
6.Functional significance and features of the structure of contractile and conducting muscle tissue of the myocardium.

VIII.Learning objective.

1.Two histological preparations are presented, one clearly shows the capillary network located between two arterioles, the second - between two veins. Give the name of the capillary network and in what organs is it located?
2.When studying the drug in the field of view of a light microscope, you can see a muscle-type artery and a vein of the same name, colored with orsein. What are the structural elements of the vessels will be coated with this dye? By what signs can you accurately determine the artery?
3.The venom of spiders and snakes containing hyaluronidase easily penetrates the capillary wall. What structural element of the walls of the blood capillary is associated with permeability and why?
4.In electron micrographs of the walls of blood capillaries are visible cells. One of them lies on the basal membrane, the other is surrounded by the basal membrane. What are these cells called?
5.The inner lining of blood vessels was impregnated with silver salts. Were identified cells with irregular sinuous borders, name the cells and the source of their development.
6.The drug contains arterioles and blood capillaries with a diameter of 20 microns. What is the basis for determining arterioles? What type of capillaries are these?
7.Two preparations of cross-striated muscle tissue are presented for medical examination. One shows symplastic structures where nuclei are located on the periphery. On the other-cellular, the nuclei are located in the center. Which of the drugs is related to heart muscle tissue?
8.When studying the ultrastructure of cardiomyocytes in the latter, well-developed myofibrils with dark and light disks, numerous mitochondria and insert disks were found. What type of heart tissue do these cells belong to?
9.There are many sensitive nerve endings in the heart muscle, but there are absolutely no effectors - motor endings. Where is the impulse to contract generated, how is it transmitted to the cardiomyocyte membrane and how is it distributed to the nearest heart cells?
10.In the myocardium of a young person who died suddenly, no pathological changes in cardiomyocytes were detected in the light microscope. A study in an electron microscope revealed a sharp expansion of the gaps between the membranes of cardiomyocytes in the composition of nexuses. Could such a violation of the nexus lead to cardiac arrest? Why?

IX.The topics of structural abstracts.
1. Ultramicroscopic structure of the capillary wall.
2. Features of microscopic and ultramicroscopic structure of vessels of the lymphatic system.
3. Vascular endothelium.
4. Angiogenesis. Formation, growth and development of blood vessels.

INDEPENDENT WORK

I. the STUDENT SHOULD KNOW:

1 General plan of the structure of the wall of arteries and veins, their classification and microscopic structure. Features of the structure of elastic vessels, the principle of the relationship between the conditions of hemodynamics and the structural organization of vessels. 2 Representation of the microcirculatory bed. The main types of blood capillaries and their microscopic structure. 3.The lining of the heart and their tissue composition, structure of heart valves. Morpho- functional features of the contractile and conducting systems of the heart.	1.Histology: textbook / edited by Yu. I. Afanasiev, N. A. Yurina. - 5th ed., pererab. and add. - M.: Medicine, 2006. 2.Histology: textbook / Under the editorship of E. G. Ulumbekova, J. A. Chelysheva. - 2nd ed., pererab. and add. - M.: GEOTAR-MED, 2009. 3.Methodological guide for students in histology. Part 2. L. A. Akoeva, L. A. gireeva, L. S. Tabolova, and others. Vladikavkaz, 2008. 4.Age and histology. Blood. The organs of hematopoiesis. Circulatory organs. Methodological guide for students of medical, pediatric, preventive medicine and dental faculties. L. A Akoeva., L,A, Gireiev, L. S. Tabolov. Vladikavkaz, 2011.

II.THE STUDENT MUST BE ABLE TO:

1.Determine morphological differences between arteries and veins of the muscular type, the structure of vessels of the microcirculatory bed at the microscopic level.

2. Determine the elastic type of artery sheath(aorta), the heart sheath at the microscopic level.

3.Perform morphological differentiation of typical and atypical cardiomyocytes at the microscopic level.

III. Tasks to prepare for the lesson:

Task 1. Fill in the table. "Differences in the structure of arteries and veins."

Vessels.	The arteries of muscular type.	Muscle-type veins
Endothelium and subendothelial layer		
Internal elastic membrane		
Muscular layer		
External elastic membrane		
Adventitious shell		

Task 2. Continue your sentences:

1. The structural and functional unit of striated muscle tissue is .....

2. Typical cardiomyocytes, in addition to cardiomyocytes that are part of the heart's conducting system, include....., whose function is to……

3. P-cells are located in the ....., their function is to.....

4. Working cardiomyocytes are connected to each other .....

5. The order of excitation by the conducting system of the heart: P-cells - .....

6. The aorta refers to the arteries..... type.

7. The elastic framework of the aortic wall is formed .....

Task 3.Complete the classification scheme for cardiomyocytes.

Task 4. Fill in the table. "Differences in the structure of the skeletal and

heart muscle tissue".

muscle tissue.	striated skeletal.	striated heart
distinctive feature		

Task 5. Make tests based on the sample.
The vessels of the microcirculatory bed include:
a. the small arteries
b. venules
c. capillaries
d. arterioles
f. arterio-venular anastomoses.

IV. Questions for self-monitoring:
1 General plan of the structure and classification of vessels.
2 the General principle of interdependence of the structure of the vessel wall and hemodynamic conditions.
3 Structural differences between arteries and veins of the muscular type.
4. What are the features of the structure and functioning of elastic vessels?
5 Features of the structure of vessels of the microcirculatory bed: arterioles, capillaries, venules, arterio-venous anastomoses.
6.The lining of the heart and their tissue composition. Functional significance and features of the structure of contractile and conducting muscle tissue of the myocardium.
7.The functional significance of intercalated disks of the myocardium.
8.Age and structural features of the heart.

TEST YOURSELF:
CHOOSE THE CORRECT ANSWERS

1. The vessels of the microcirculatory bed do not include:
a. Vessels > 100 microns in diameter.
b. Arterioles.
c. Capillaries.
d. Venules.
f. Arteriolo-venular anastomoses..

2.Which of the following structures is not part of emocapella?

a. Elastic membrane.

b. Smooth myocytes.

c. Subendothelial layer.

d. Basal membrane.

f. Endothelium.

3. Not in the myocardium:

a. Intercalated disc

b. Anastomoses between cells

c. Large number of capillaries

d. 1-2 nuclei and the center of the cell

f. Abundance of loose connective tissue between cells

4. Not in the endocard:

a. Endothelial

b Subendothelial layer

c.Muscle-elastic layer

d.External connective tissue elephant

f.Layer of blood vessels

5. Which of the following veins refer to the veins of muscular type with strong development of muscular elements?

a. Brachial vein.

b.Femoral vein.

c. Veins of the bones.

d.Superior Vena cava.

6. Sinusoid capillaries:

a. Located in the red bone marrow.

b. Found in the spleen and liver.

b. Found in the skin and muscles.

c. Have a diameter of 8-10 microns.

d. Have a diameter of 20-30 microns.

7. The endocardium contains all layers except:

a. Endothelium.

b. Subendothelial.

c. The Muscular-elastic.

d. External elastic membrane

8. For muscle-type arteries, it is typical:

a. The Outer elastic membrane is better expressed than the inner one.

b. Smooth Muscle cells in the middle shell are oriented spirally.

c. Adventitia, numerous nerve fibers are present.

d. Control blood flow to the organs.

9. Capillaries. Everything is correct EXCEPT:

a. Contain pericytes.

b. Contain smooth muscle cells.

c. Ensure the exchange of substances between blood and tissues.

10. Which of the following structures are part of emocapella?

a. Endothelium.

b Basal membrane.

c. Pericytes.

d. Adventitial cells.

f. Smooth Muscle cells.

MODULE 3
Targets.
1. Show knowledge of theoretical material on the studied topics.
2. Be able to determine and differentiate histological structures of tissues in micro-preparations.
3. Solve situational problems and tests.
4. Show knowledge in defining electronograms.

Control question:
1. Classification of sense organs according to the genetic and morphological characteristics.
2. Embryonic sources of development of the main structural components of the eye.
3. The main membranes of the eye, the features of their structure.
4. Characteristics of functional devices of the eye.
5. Neuronal composition of the retina, features of the ultramicroscopic structure of sensorineural cells.
6. Sources of development of the organ of hearing and balance.
7. Structure of the outer and middle ear.
8. Structure of the vestibular apparatus of the inner ear, morphofunctional characteristics of sacs and ampoules.
9. Name and describe the walls of the membranous labyrinth of the snail, their functional significance.
10. The structure of the spiral (Korteweg) of the body, morphological and functional properties of sensory and supporting cells.
11. Sources of development and components of the cardiovascular system, the functional significance of its various departments.
12. Arteries, General plan of structure, classification.
13. Veins, General plan of structure, classification.
14. Vessels of the microcirculatory bed, structural features.

15. The lining of the heart and their tissue composition.
16. Functional significance and features of the structure of contractile and conducting muscle tissue of the myocardium.
17. The functional significance of intercalated disks of the myocardium.
18. Age and structural features of the heart.

Micropreparations:
1. Cornea of the eye (color hematoxylin-eosin).
2. Back wall of the eye (hematoxylin-eosin stain).
3. Retina in the dark and in the light (hematoxylin-eosin stain).
4. Cortical organ (hematoxylin-eosin stain)
5. Muscle-type artery (hematoxylin-eosin stain)
6. Muscle-type vein (hematoxylin-eosin stain)
7. Vessels of the microcirculatory bed (hematoxylin-eosin staining)
8. The aorta is an elastic type of artery (orsein staining).
9. Heart wall (hematoxylin-eosin stain).

Test task

TOPIC: ORGANS OF HEMATOPOIESIS AND IMMUNE PROTECTION.
PC-9

I. Motivational characteristics of the topic.
Blood, lymph and organs where they are formed, as well as blood cells that have "moved out" into connective and epithelial tissues, make up the blood system, which is involved in maintaining the constancy of the internal environment of the body and protecting genetic integrity. Hematopoiesis and the formation of immune functions of blood cells is a complex multi-stage process, violations of which lead to a number of diseases. Knowledge of normal hematopoiesis, the structure and participation of hematopoietic organs in the body's protective reactions is necessary for a doctor of any profile.

II. Targets.
1.Know the unitary theory of hematopoiesis. Have an understanding of the unitary theory of hematopoiesis and blood stem cell.
2.Know the features of postembryonic hematopoiesis.
3.To study the features of the structure and functioning of various hematopoietic organs, their role in the formation of humoral and cellular immunity.

III. The required initial level of knowledge.
a) from the previous topics:
1.The content of the concept of "reticular tissue".
2.Scheme of post-embryonic hemopoiesis-lymphocytopoiesis.
b) from the current session:
1.General characteristics of Central and peripheral hematopoietic organs.
2.Sources of development and the General plan of structure, and the functional significance of the red bone marrow and thymus.
3.Sources of development and the General plan of the structure, and the functional significance of the lymph nodes.
4. Sources of development and the General plan of the structure, and the functional significance of the spleen.
5.Functional significance and Prince of the organization of lymphoepithelial organs on the example of the Palatine amygdala and Appendix.

IV. Object of study.
a) micro-products for self-study
1. Thymus (hematoxylin-eosin stain)
2. Lymph node (hematoxylin-eosin stain)
3. Spleen (hematoxylin-eosin stain)
b) electronic messages
No. 317, 322, 340.

V. Information part.

The organs of hematopoiesis and immunological protection include: red bone marrow; thymus; lymph nodes; spleen and lymph nodes of the digestive tract. There are Central (thymus, red bone marrow) and peripheral hematopoietic organs (the rest).
The red bone marrow is the Central organ of hematopoiesis, containing hematopoietic stem cells and performing myeloid, lymphoid hematopoiesis, erythropoiesis, and thrombocytopoiesis. It is a universal hematopoietic organ. The basis of the organ is a reticular stroma, through which many blood vessels pass. The most intense hematopoiesis occurs near the endost. Hematopoietic cells are located in Islands surrounding the macrophage. Granulopoietic cells form Islands surrounded by proteoglycans. Megakaryoblast and megakaryocytes are in contact with slits capillaries. There are also small clusters of bone marrow lymphocytes and monocytes.
The thymus (thymus or goiter) is the Central organ of lymphocytopoiesis (T-lymphocytes) and immunogenesis. On the basis of reticuloendothelial fabric. Here there is an antigen-independent differentiation of t-lymphocyte precursors into T-lymphocytes, which carry out cellular immunity reactions and regulate humoral immunity reactions. Removal of the thymus leads to a weakening of the immune system, rejection of organ transplants and increased sensitivity to infectious diseases. In the cortical substance is gematotropnye barrier. The thymus reaches its maximum development in early childhood. From 3 to 20 years, there is a stabilization of the mass, and then there is an age-related involution of the thymus gland. During the stress reaction, accidental involution occurs.
Lymph nodes - peripheral organs of lymphocytopoiesis, immunological protection and Deposit of leaking lymph. This is a parenchymal organ covered with a connective tissue capsule, consisting of cortical and cerebral matter, as well as sinuses. The cortical substance consists of cortical and paracortical (thymus-dependent, which mainly contains T-lymphocytes) zones. The cortical part consists of many lymphatic follicles (consisting of B-lymphocytes, follicular process cells and macrophages). The brain substance is represented by trabeculae, brain cords, and sinuses. Sinuses of the lymph node: marginal, intermediate, sinuses of the medulla.

The spleen is an organ of peripheral hematopoiesis, involved in the formation of cellular and humoral immunity, the production of substances that inhibit erythropoiesis in the red bone marrow. It takes part in the elimination of aging red blood cells and platelets. The spleen is covered with a connective tissue capsule containing smooth muscle cells. The spleen is a parenchymal organ based on reticular tissue. The parenchyma is formed by a white and red pulp. In the reticular stroma of the red pulp, red blood cells predominate and numerous macrophages are present that destroy obsolete red blood cells. White pulp-clusters of globular nodules and periarterial sheaths. In the lymph node, there is a periarterial zone (consisting of T-lymphocytes), a reproduction center (consisting of proliferating B-lymphocytes), a mantle zone (consisting of small B-lymphocytes and a small number of T-lymphocytes) and a marginal or marginal zone (consisting of B - and T-lymphocytes). The nodule artery (Central artery) runs eccentrically through the nodule.

VI. Learning activity.

1.Using the classroom tables, learn to identify Islands of red bone marrow hematopoietic cells, be able to distinguish them, and know the features of cell differentiation in each hematopoietic row.

2.On the micro-preparation "Thymus" find and draw a connective tissue capsule (1) covering the organ, under which the lobules of the gland (2) are visible. In the lobule, you can distinguish a darker cortical (3) and a light - brained (4) substance. The basis of the lobule is epithelial tissue. Layered epithelial cells form Hassal corpuscles (5), located in the brain substance.

3.On the micro-drug "Lymph node" find and draw a connective tissue capsule (1), from which the trabeculae (2) depart inside the organ. Under the capsule is a darker cortical substance (3), represented by lymphoid nodules (4). The periphery of the nodule is formed by Mature lymphocytes (5), the Central part (the center of reproduction, the reactive center) is represented by lymphoblasts (6). From the lymphoid follicles depart ribbon-like clusters of lymphocytes-brain strands (7). Between the follicles, trabeculae and brain cords, light spaces are visible-sinuses (8).

4.Find and draw a connective tissue capsule (1) covered with mesothelium (2) on the spleen micropreparation. From it, the trabeculae(3) extend deep into the organ, in which blood vessels are clearly visible (4). The parenchyma of the organ is represented by a white pulp-lymphoid follicles (5) , consisting of a cluster of lymphocytes around the Central artery (6). Between the follicles and the trabeculae is a red pulp (7) - sinusoid capillaries filled with blood.

5.Mark the drawings.

VII. Control question.

1.General characteristics of hematopoietic organs and their classification.

2.Structure, localization, features of postembryonic hematopoiesis of the red bone marrow.

3.Thymus, structure, localization, features of hematopoiesis, functions. Age-related and accidental thymus involution.

4.Localization, structure and function of lymph nodes.

5.Features of blood circulation, localization, structure, functional value of the spleen.

VIII. Learning objective.

1.When transplanting foreign tissue, the recipient animal develops protective reactions that cause the death of the transplanted tissue. Which cells of the recipient body cause the death of the transplanted tissue and in which hematopoietic organ are they formed?

2.When the thymus is removed from a newborn animal, pronounced morphological changes occur in the peripheral lymphoid organs. Which areas of the spleen and lymph nodes most clearly respond to this operation, and what is their intra-organ specialization?

3.The researcher in the histological preparation of the spleen revealed an increased content of iron. What is the source of iron in the spleen? What does the increase in its content indicate?

4.The patient has impaired processes of erythropoiesis, granulocytopoiesis, monocytopoiesis, and thrombocytopoiesis. Which hematopoietic organ pathology is indicated by these disorders?

5.The gunshot wound caused acute bleeding. How will this condition affect the hematopoietic activity of the bone marrow, the number of blast cells?

6.If a newborn animal has a thymus removed and then a foreign graft is transplanted, the rejection reaction does not develop. Explain the reason for this phenomenon.

7.The animal was placed in sterile conditions immediately after birth. Can secondary follicles form in peripheral hematopoietic organs in this situation, if so, why, and if not, why?
8.The student claimed that the spleen in the postembryonic period is one of the organs of hematopoiesis, but he did not answer questions about where it occurs in the spleen and what shaped elements of blood are formed in this case. How do you answer these questions?
IX. The topics of structural abstracts.
1. Age-related thymus involution and its changes under the influence of stress.
2. The structure of the thymus and differentiation of T-lymphocytes.

INDEPENDENT WORK

I. THE STUDENT SHOULD KNOW:

1. Unitary theory of hematopoiesis 2. The concept of a hematopoietic stem cell 3. Features of post-embryonic hematopoiesis 4. Classification of hematopoietic organs 5. Localization, features of structure and functioning, role in the formation of humoral and cellular immunity: bone marrow, thymus, lymph nodes and spleen. 6. The concept of age-related and accidental thymus involution 7. Features of blood supply and lymph flow in the lymph nodes and spleen	1.Histology: textbook / edited by Yu. I. Afanasiev, N. A. Yurina. - 5th ed., pererab. and add. - M.: Medicine, 2006. 2.Histology: textbook / Under the editorship of E. G. Ulumbekova, J. A. Chelysheva. - 2nd ed., pererab. and add. - M.: GEOTAR-MED, 2009. 3. Methodological guide for students in histology. Part 1. L. A. Akoeva, L. A. gireeva, L. S. Tabolova, and others. Vladikavkaz, 2008. 4.Age and histology. Blood. The organs of hematopoiesis. Circulatory organs. Methodological guide for students of medical, pediatric, preventive medicine and dental faculties. L. A Akoeva., L,A, Gireiev, L. S. Tabolov. Vladikavkaz, 2011.

II. THE STUDENT MUST BE ABLE TO:

1.Using the classroom tables, determine the Islands of hematopoietic cells and distinguish them.

2.Determine at the microscopic level the structural components of hematopoietic and immune defense organs

III. Tasks to prepare for the lesson:

Task 1. Fill in the table: "the White pulp of the spleen»

Zone.	Localization.	Cellular composition.	Functional significance

Task 2. Continue your sentences:

«Lymph node».

1. The basis of the lymph node is ..... cloth.
2. The main structural component of the cortical substance are..... Their Central part looks brighter because CTO.....
...
3. The microenvironment for lymphocytes paracortical areas are.....cells. They produce....., which ……..……...

4. The sinuses called..... Distinguish between sinuses:.....……
……..

Task 4. Make 2-3 test tasks based on the sample.
The stromal component of the red bone marrow is mainly formed:
A) bone tissue
B) epitheliomuscular cloth
C) loose connective tissue
D) adipose tissue
E) reticular tissue

IV. Questions for self-monitoring
1. Classification and sources of development of hematopoietic organs and immune protection.
2. Features of the microscopic structure and main functions of the bone marrow.
3. Thymus: structure and role in the processes of immunogenesis. Gematotropnye barrier.
4. Age-related and accidental thymus involution.
5. The structure of white and red pulp of the spleen.
6. The concept of closed and open blood circulation of the spleen.
7. Structure and functional significance of t-zones of lymph nodes.
8. Structure and functional value of b-zones of lymph nodes.

TEST YOURSELF:
CHOOSE ONE CORRECT ANSWER
1.Where are the precursors of lymphocytes formed?
a. in the thymus.
b. in the spleen and lymph nodes.
c. in the lymphatic follicles of the digestive canal.
d. in the red bone marrow.

2.Where are the layered epithelial bodies of Hassal?
a. in the red bone marrow.
b. in the medulla of the thymus lobes.
c. in the cortical substance of the thymus lobes.
d. in the brain substance of the lymph nodes.
f. in the lymphoid follicles of the spleen.

3.What happens in the lymph nodes?
a. antigen-dependent proliferation and differentiation of t and b lymphocytes.
b. formation of monocytes.
c. formation of neutrophilic granulocytes.
d. antigen-independent proliferation of B-lymphocytes.

4.Where is the T - zone located in the lymph nodes?
a. in the cortical substance.
b. in the brain substance.
c. in the paracortical zone.
d. in the area of the gate.

5.Which cells produce antibodies?
a. fibroblasts.
b. macrophages.
c. plasma cells.
d. eosinophilic granulocytes.
f. t - helper cells.

SELECT THE CONDITION UNDER WHICH THIS STATEMENT IS TRUE

6. What morphological changes accompany the ripening of cells

the granulocytic series?

a. the core disappears.

b. accumulation of specific granularity in the cytoplasm.

c. changing the shape of the core from rounded to segmented.

d. accumulation of hemoglobin.

7. Where does antigen-dependent differentiation of B-lymphocytes begin?

a. in the paracortical zone of the lymph node.

b. in the red bone marrow.

c. in the lymphoid follicles of the spleen.

d. in the lymphoid follicles of the cortical zone of the lymph node.

f. in the lobules of the thymus gland.

8. What cells are present in the lobule of the thymus gland?

a. macrophages.

b. b-lymphoblasts.

c. t-lymphoblasts.

d. epithelial cells.

f. t-lymphocytes.

e. fibroblasts.

9. What cells of the thymus gland form and secrete thymosin?

a. Epitheliomuscular.

b. Macrophages.

c. Fibroblasts.

d. T-lymphocytes.

10. Where does antigen-dependent differentiation of B-lymphocytes begin?

a. in the paracortical zone of the lymph node.

b. in the red bone marrow.

c. in the lymphoid follicles of the spleen.

d. in the lymphoid follicles of the cortical zone of the lymph node.

f. in the lobules of the thymus gland.

TOPIC: ENDOCRINE SYSTEM.
PC-9

I. Motivational characteristics of the topic.
Regulation and coordination of body functions is provided by the action of the nervous and endocrine systems. Organs of the endocrine system (endocrine glands) are an efferent link of the regulating system designed to maintain homeostasis in the body. They perform their function with the help of hormones released into the blood. A change in the functional activity of these organs is accompanied by a restructuring of their structure and, conversely, a violation of the structure of organs entails an imbalance of the corresponding hormones. The knowledge acquired on this topic is necessary for understanding the morphological manifestations of disorders of hormonal regulation.
II. Targets.
1. To study the General laws of the structure of endocrine organs.
2. Know the mechanisms of hypothalamic control of endocrine functions and the morphology of structures that provide it.
3. To understand the role of glandular cells of endocrine organs in the production of certain hormones.

III. The required initial level.
a) from the previous topics:
1. Features of the structure and function of secretory cells.
2. The concept of endocrine and exocrine glands.
3. The structure of the neurosecretory cells.
b) from the current session:
1. Structural and functional characteristics of endocrine glands.
2. Classification of endocrine system organs.
3. Sources of development, structure and function of the endocrine glands.
4. Structure and function of the neural secretory nuclei of the hypothalamus.
5. Endocrine gland hormones and their significance.
6. The concept of a diffuse endocrine system.
7. Structure and function of the pituitary, adrenal, thyroid and parathyroid glands.

IV. Object of study.
a) micro-products for self-study
1. Cat's pituitary gland (color hematoxylin-eosin).
2. The adrenal gland (color hematoxylin-eosin).
3. The thyroid gland (color hematoxylin-eosin).
4. Parathyroid gland (color hematoxylin-eosin).
b) electronic messages

№№328, 332,346, 347, 349.

V. Information part.
The endocrine system together with the nervous system regulates and coordinates the functions of the body. The endocrine system consists of specialized endocrine glands, devoid of excretory ducts, richly supplied with vessels of the microcirculatory bed, which secrete products of secretion, single endocrine cells (diffuse endocrine system DES), scattered across various organs and tissues. Among single hormone-producing cells, there are two independent groups: I-neuroendocrine cells of the APUD-series (1-derived neuroectoderm; 2-derived skin ectoderm; 3-derived intestinal endoderm; 4-derived mesoderm; 5-derived mesenchyma), II - cells of non-neural origin (this group includes cells of endocrine and non-endocrine organs that secrete hormones.
The pituitary consists of three lobes: anterior, middle, and posterior. The anterior lobe is formed by chromophilic and chromophobic cells that produce follitropin, lutropin, tyrotropin, adrenocorticotropin, somatotropin, and prolactin. The average share produces melanocortin and lipotropin. The anterior and middle lobes form the adenohypophysis. The adenohypophysis is connected to the hypothalamus by a single blood supply system. In the posterior lobe - the neurohypophysis, antidiuretic hormone (vasopressin) and oxytocin are accumulated, which are produced in the neurosecretory nuclei of the anterior hypothalamus.
The adrenal glands are paired organs consisting of two independent hormone-producing glands that make up the cortex and brain matter of different origin. In the cortex there are three zones: glomerular, bundle and mesh, which produce respectively mineralocorticoids, glucocorticoids, analogs of male and female sex hormones. The brain substance produces catecholamines (epinephrine and norepinephrine).
The thyroid gland is a parenchymal lobular organ. The structural unit of the lobule is the follicle, in which the cells of thyrocytes synthesize iodine - containing hormones-thyroxine and triiodothyronine, which regulate the basic metabolism of the body. In the interfollicular layers of connective tissue are located parafollicular cells that secrete the hormone calcitonin (regulates the exchange of calcium in the body).

The parathyroid glands are a parenchymal organ in which parathyroid cells form strands. There are: main, oxyphilic and fat cells. The main function(main cells) is the production of the hormone parathyrin (PG), which increases the level of calcium in the blood.

VI. Learning activity.

1.On the microparticle "pituitary" find and draw: the anterior lobe (I), the middle lobe (II), which completely surrounds the posterior (III). In the anterior lobe, cells are arranged in strands around sinusoid capillaries (1) lined with endothelium. The bulk of the anterior lobe cells are poorly colored cells with large nuclei - the main ones (2). Among them, groups of eosinophilic cells are located (3). Basophilic cells (4) are less common. The middle (intermediate) lobe has the form of a narrow strip adjacent directly to the posterior lobe. It is a cluster of small cells lying in many rows, between which capillaries are visible. The posterior lobe is formed by axons of neurosecretory cells of the supraoptic and paraventricular nuclei of the neuroglia (5), represented by pituitary cells (6).

2.Find and draw a connective tissue capsule with large blood vessels (1), under which there are cortical (I) and cerebral (II) substances. The outer glomerular zone (2) is formed by rounded clusters of small cells; deeper is the bundle zone (3), in which large cells are arranged in bundles. The mesh zone (4) consists of strands of small cells intertwining like a network. The brain substance is formed by large cells, between which there are sinusoid capillaries(5).

3. On the micro-product "Thyroid gland" find and draw a lobule of the thyroid gland (I), the bulk of which is made up of follicles (1) - closed glandular vesicles. The follicle wall is formed by thyrocytes (2), the follicle cavity is filled with colloid (3). Parafollicular cells are located between the follicles mainly in the Central part of the lobes of the gland (4).

4.On the micro-preparation "Parathyroid gland" find a connective tissue capsule (1), from which connective tissue layers (2) with blood vessels (3) enter into the body. The parenchyma of the gland is represented by epithelial cords (4) consisting of small cells.

5.Mark the drawings.

VII. Control question.

1.The concept of organs of the endocrine system and endocrine cells of non-endocrine organs. Connection of the nervous and endocrine systems.
2.Functional classification of endocrine glands. Hypothalamic-pituitary system.
3.Neural secretory nuclei of the hypothalamus. Neurohormones, their effect on the body.
4.General morphofunctional characteristics of the pituitary gland, its hormones.
5.Features of the structure of the cortical and cerebral substances of the adrenal gland, its hormones.
6.Thyroid. Structure, localization, hormones and their role.
7.Microscopic and ultramicroscopic structure of the parathyroid glands and their role in the body.

VIII. Learning objective.

1.A woman during childbirth has a decrease in the contractile capacity of the uterus. What hormone released by the hypothalamus can increase the contractility of the uterus in this situation?

2.The animal's thyroid was removed. Hypertrophy, which cells will be detected in the animal?
3.In a proportionally built child, there was a decrease in the growth rate. What pituitary hormone secretion deficiency may be associated with this lag?
4.On the preparation of the thyroid gland visible follicles with a flat epithelium, filled with dense colloid. What functional state of the gland is indicated by this picture?
5.The animal's parathyroid gland was removed. How will the level of calcium in the blood change?
6.One section of the thyroid gland is examined after staining with silver nitrate, the other-after the introduction of radioactive iodine into the body. Which cells of the gland will be detected in each section? What hormones do they secrete?
7.Viewing a series of preparations of the adrenal glands, the researcher noted that different sections show areas of the organ consisting of: 1-strands of epithelial cells located near the connective tissue capsule in the form of rounded clusters: 2-lighter, which form strands oriented in one longitudinal direction; 3-clusters of large basophilic cells, which on specially colored preparations show affinity for chromium, silver, osmium salts. Which parts of the adrenal gland were analyzed in each case? What is the functional value of the constituent cells?
8.During embryogenesis, the migration of neuroblasts from ganglion plates was experimentally disrupted. On the structure of what endocrine organs, and how will such an intervention affect?
IX.The topics of structural abstracts.
1. Features of the structure of capillaries of endocrine glands.
2. Ultrastructure and morphology of parafollicular cells of the thyroid gland.
3. Modern understanding of the role of the epiphysis in the system of neuroendocrine regulation.
4. Histology and biochemistry of chromaffin tissue of the adrenal glands.

INDEPENDENT WORK

1.THE STUDENT SHOULD KNOW:

1.Structural and functional characteristics of endocrine glands. Classification of endocrine system organs. 2. Structure and function of the neural secretory nuclei of the hypothalamus. Structure and function of the pituitary gland. 3. Structure and function of the adrenal glands 4. Structure and function of the thyroid gland. 5. Structure and function of the parathyroid glands.	1.Histology: textbook / edited by Yu. I. Afanasiev, N. A. Yurina. - 5th ed., pererab. and add. - M.: Medicine, 2006. 2.Histology: textbook / Under the editorship of E. G. Ulumbekova, J. A. Chelysheva. - 2nd ed., pererab. and add. - M.: GEOTAR-MED, 2009. 3. Methodological guide for students in histology. Part 2. L. A. Akoeva, L. A. gireeva, L. S. Tabolova, and others. Vladikavkaz, 2008.

II. THE STUDENT MUST BE ABLE TO:

Determine the organs of the endocrine system and their components at the microscopic level.

III. Tasks to prepare for the lesson:

Task # 1. Fill in the tables.

1.Organs of the endocrine system

Central endocrine organs	1. 2. 3.
Peripheral endocrine glands	1. 2. 3.
Organs that combine endocrine and non-endocrine functions	1. 2. 3.
Single hormone-producing cells (components of the diffuse endocrine system)	

2.Anterior pituitary lobe (complete the missing information)

Action

Hormones	Действие
1-3. Gonadotropic hormone: follicle-stimulating hormone (FSH), luteinizing hormone (LH), or lutropin, lactotropic hormone (LTG), prolactin, or luteotropic hormone.	1. FSH stimulates 2. LG stimulates 3. LTG stimulates
4-5. Hormones that stimulate other (non-sexual) glands: thyroid-stimulating hormone (TSH), adrenocorticotropic hormone (ACTH).	4. TSH stimulates the formation of thyroid hormones 5. ACTH stimulates the formation of hormones in the adrenal cortex.
6. Somatotropic hormone (STH), growth hormone, or somatotropin	6. STG stimulates

3.Medium (intermediate) lobe of the pituitary

Hormones	Action
1. Melanocytestimulating hormone (MSG), or melanocortin. 2. Lipotropin	1. MSG encourages 2. Lipotropin stimulates

4.Posterior pituitary lobe

In the posterior pituitary:

The task № 2. Fill in the table: "Thyroid gland" (fill in the missing information)

Hormones	Action

1. Thyroid hormone: thyroxine and its precursors – triiodothyronine, diiodothyronine.	Thyroid hormone a) stimulate b) speed up processes
2. Calcitonin	Calcitonin reduces … slimming … by increasing …

Task 3. Fill in the table: "adrenal Gland" (fill in the missing information)

1.Cortical substance

1. Mineralocorticoid: aldosterone	a) Aldosterone strengthens … raises -…
2. Glucocorticoids: cortisone, corticosterone, hydrocortisone.	Glucocorticoids carry out a) stimulate … b) increase …
3. Androgens: Androstenedione, etc. (synthesized in the adrenal glands of both men and women)	Androstenedione (as well as other androgens - male sex hormones) stimulates but) … b) development …

2.Brain substance

Hormones	Action
Catecholamines: adrenaline, norepinephrine	Epinephrine a) entering the bloodstream… b) stimulates

Task 4. Make 2-3 test tasks based on the sample.
What hormones does ACTH stimulate?
1.Aldosterone 2.Glucocorticoids
3.Androgens'
4.Thyroxine's

IV. Questions for self-monitoring:
1. The concept of organs of the endocrine system and endocrine cells of non-endocrine organs. Connection of the nervous and endocrine systems.
2. Functional classification of endocrine glands, hypothalamic-pituitary system.
3. Neural secretory nuclei of the hypothalamus. Neurohormones, their effect on the body.
4. General morphofunctional characteristics of the pituitary gland, its hormones.
5. Features of the structure of the adrenal cortex and medulla, its hormones.
6. The thyroid gland, Structure, localization, hormones and their role.

7. Microscopic and ultramicroscopic structure of the parathyroid glands and their role in the body.
8. The pineal gland, its structure and function.

TEST YOURSELF:
CHOOSE ONE CORRECT ANSWER
1.In which Department of the adrenal glands are synthesized hormones that suppress inflammatory processes:
a. in the glomerular zone
b. in the beam zone
c. in the mesh zone
d. in the brain substance

2.The bundle zone of the adrenal cortex occupies:

a. about 75% of the bark thickness

b. about 25% of the bark thickness

c. about 50% of the bark thickness

d. about 90% of the bark thickness

3.The main cells that produce parathyrin are:

a. neutrophilic parathyroid cells

b. the main partiality

c. the parafollicular endocrinocytes

d. oxyphilic parathyrocytes

4. Specify the place of formation of steroid hormones?

a. adenohypophysis.

b. the brain part of the adrenal glands.

c. thyroid gland.

d. bundle zone of the adrenal cortex.

f. the neurohypophysis

5.What cells are located in the posterior pituitary lobe?

a. basophilic adenocytes.

b. the oxyphilic identity.

c. chromophobic cells.

d. glial cells (pituitary cells).

SELECT THE CONDITION UNDER WHICH THIS STATEMENT IS TRUE

6. What features of the structure of follicles are observed in hypofunction of the thyroid gland?

a. decrease in the size of follicles.

b. increasing the size of follicles.

c. flattening of the epithelium.

d. thickening and cracking of the colloid.

f. the epithelium becomes high prismatic.

7. What glands are affected by the tropic hormones of the adenohypophysis?

a. testes and ovaries.

b. the thyroid gland.

c. the parathyroid gland.

d. the adrenal cortex.

8. What hormones does ACTH stimulate?

a. aldosterone.

b. glucocorticoids (corticosterone).

c. androgenov.

d. thyroxine.

9.What processes in the body are regulated by the endocrine system:

a. metabolism and energy

b. secretion and excretion

c. growth, reproduction, reproduction and differentiation of cells

d. suction

10.The features of the action of hormones include:

a. selectivity

b. distance

c. specificity

d. accumulation of

f. high activity in small doses

TOPIC: SKIN AND ITS DERIVATIVES.

PC-9

I. Motivational characteristics of the topic.

The skin, forming the outer cover, performs many vital functions

important function. Color, temperature, humidity and other indicators can tell the doctor about age, gender, hormonal status, the presence and stage of development of the disease, etc.the Study of the fine structure of the skin and its derivatives serves as the basis for forming the doctor's ideas about the functions of the skin in normal and pathological conditions.

II. Targets.

1. Know at a microscopic level the structure of the skin layers, their tissue elements and skin derivatives (glands, hair, nails).

2. Explain the structural features of the skin and its derivatives in various topographic zones in connection with the function performed.

3. Explain the structural organization of the skin due to environmental factors.

III. The required initial level of knowledge.

a) from the previous topics:

1. The structure of multilayer plane not becoming Horny epithelium.

2. Structure of the connective tissue itself.

b) from the current session:

1. Source of skin development.

2. General plan of the structure and tissue composition of the skin.

3. Receptors in the skin

4. Derivatives of the skin.

IV. Object of study.

a) micro-products for self-study:

1. The skin of a human finger. "Thick skin" (color hematoxylin-eosin).

2. Skin with hair. "Thin skin" (hematoxylin-eosin color).

b) electronic messages

No. 465.

V. Information part.

The skin forms the outer cover of the body. It consists of two parts-epithelial and connective tissue. The skin epithelium (epidermis) is a multi - layer flat keratinized, consisting of 5 layers: basal, spiny, granular, shiny, and Horny. The connective tissue part of the skin (dermis) includes two layers: papillary and reticular. The papillary layer consists of loose connective tissue rich in blood vessels and nerve endings. This layer defines the individual skin pattern. The mesh layer is formed by dense unformed connective tissue, bundles of collagen fibers in which form a network. This layer of skin contains skin derivatives-glands and hair. Sweat glands-simple, tubular,

unbranched, secreted by merocrine and partially apocrine type. The sebaceous glands are simple, alveolar, branched, and secrete a holocrine type. Their exit ducts open directly into the hair funnel. Hair can be long, bristly, downy. They are epithelial appendages of the skin. In the hair, there are two parts: the rod and the root. The hair root is located in the hair SAC, the wall of which consists of two epithelial sheaths - external and internal. Outside, the hair SAC is surrounded by a connective tissue dermal vagina (hair bag). The root of the hair ends in a hair bulb, into which the hair papilla (loose connective tissue rich in blood vessels) is pushed. At the junction of the hair root to the rod, the skin's epidermis forms a hair funnel. The hair itself consists of a brain, cortical substance and cuticle.

VI. Learning activity.

1. On the micro-product "finger Skin" consider the epidermis, dermis, subcutaneous fat. In the dermis, find the end sections and excretory ducts.

2. Find and draw the epidermis (I), dermis (II), and subcutaneous fat (III) on the micro-product "Skin with hair". The following layers are distinguished in the epidermis: basal (1), spiny (2), granular (3), shiny (4), Horny (5). The connective tissue papillae of the dermis are deeply embedded in the basal layer of the epidermis, making up its papillary layer (6), which goes deeper into the reticular layer of the dermis (7), underlain by subcutaneous tissue (8). In the deep layers of the dermis, there are encapsulated nerve endings (9). In the reticular layer of the dermis and subcutaneous fat are located the end sections of the sweat glands (10), lined with cubic epithelium (11), surrounded by myoepithelial cells (12). The hair roots are also located here. At the end of the root there is a hair bulb (13), into which the hair papilla (14) is pushed. The hair is well defined located in the center of the brain

substance (15), on both sides of which is located the cortical substance (16) and one layer of flat cells - the cuticle (17). The hair root is surrounded by two epithelial sheaths: external (18) and internal (19). The cells of the inner root vagina move up to the level of the confluence of the sebaceous gland, where they are flushed, so there is no inner root vagina above the level of the sebaceous gland. Around the epithelial vagina is a connective tissue hair bag (20). Near the roots of the hair, there are sebaceous glands (21), whose short excretory ducts open into the hair funnel (22). A muscle that lifts the hair is attached to the hair (23).

3.Mark the drawing.

VII. Control question
1.General plan of the skin structure. Skin function.
2.Skin derivatives: sweat and sebaceous glands, their structure, localization, types of secretion.
3.Hair, hair types, structure, role of the hair bulb.
VIII. Learning objective.
1.As a result of the disease, the function of the sebaceous glands decreased. What changes will occur in the state of the epidermis and hair?
2.In the dermis of the skin there are bundles of smooth muscle cells, the contraction of which causes the appearance of the so-called "goose skin". What is the significance of this reaction?
3.Two preparations of sweat glands are presented. On the first end sections of the glands are larger than on the second, their secret is richer in protein substances. What type of glands are represented on the first and second preparation?
4.Sweat glands that secrete apocrine type function in a certain age period. What endocrine glands are involved in this?
5.It is known that the epidermis and dermis contain pigment cells. What are their structural and functional differences?
6.The body is in a state of starvation. In which areas of the body does the skin retain a layer of subcutaneous fat, even when it is extremely depleted? Why?
7.Under the influence of UV rays, most of the skin of Europeans turns brown. When the UV light ceases, it brightens after a while, except for certain areas (around the nipple of the breast, scrotum, etc.). What determines the skin color that changes under UV irradiation? What cells are involved in this?
The topics of structural abstracts.
1.Age-related changes in skin morphology and cytochemistry.
2.Morphological features of various skin areas.
3.Morphological features of blood vessels of the skin.

INDEPENDENT WORK
I.THE STUDENT SHOULD KNOW:

1. Structure of skin layers, their tissue elements and skin derivatives (glands, hair, nails). 2. Structural features of the skin and its derivatives in various topographic zones in connection with the function performed. 3. Features of the structural organization of the skin due to the influence of environmental factors.	1.History: textbook / edited by Yu. I. Afanasiev, N. A. Yurina. - 5th ed., pererab. and add. - M.: Medicine, 2006. 2.Histology: textbook / Under the editorship of E. G. Ulumbekova, J. A. Chelysheva. - 2nd ed., pererab. and add. - M.: GEOTAR-MED, 2009. 3. Methodological guide for students in histology. Part 2. L. A. Akoeva, L. A. gireeva, L. S. Tabolova, and others. Vladikavkaz, 2008.

II. THE STUDENT MUST BE ABLE TO:

At the microscopic level, distinguish the components of the skin, find structures in the drug that build hair and determine the glands.

I. Tasks to prepare for the lesson:
Task 1. Fill in the table: "Differences in the structure of thick and thin skin»

	localization.	epidermis.	dermis.	Derivatives of the skin
thick skin				

thin skin				

Task 2. Fill in the table: "skin Glands»

Name of the gland.	Sweat gland.		Sebaceous gland
	merocrine	apocrine	
localization			
part of the secret			
terminal divisions and their cellular composition			
excretory duct			

Task 3. Continue your sentences:
"The structure of the hair»
There are three types of hair: .....(hair of the head, beard, mustache, armpits and pubis), bristly (hair……
……..), ...(the rest of the hair).
Part of the hair is included: ....., ..……...…….. A hair bag is.....
……....
Task 4. Make 2-3 test tasks based on the sample.
What layers of the epidermis contain melanocytes?
1. Basal.
2. Thorny.
3. Granular.
4. Brilliant.
5. Horny.

1V. Questions for self-monitoring
1.General plan of the skin structure. Skin function.
2.Skin derivatives: sweat and sebaceous glands, their structure, localization, types of secretion.
3.Hair, hair types, structure, role of the hair bulb.
TEST YOURSELF:
CHOOSE ONE CORRECT ANSWER

1.The structure of the sebaceous glands:
a. complex alveolar-tubular branched
b simple alveolar unbranched
c.in a simple branched alveolar
d. complex tubular branched

2.Which of the listed cells of the epidermis perform immunological functions:
a.Merkel's cells
b. keratinocytes
c.into the melanocytes

d. Langerhans cells

3.The hair follicle (SAC) is formed:
a loose fibrous connective tissue
b epithelial tissue
c.in muscle tissue
d. adipose tissue

4.In what part of the skin are the end sections of the sweat glands located:
a. in the epidermis
b in the deep parts of the reticular layer of the dermis
c. at the border of the reticular and papillary layers of the dermis
d. in the papillary layer of the dermis

5.On the structure of the sweat glands:
a. simple tubular branched
b. simple tubular unbranched
c.in a simple branched alveolar
d. complex tubular branched

SELECT THE CONDITION UNDER WHICH THIS STATEMENT IS TRUE
6.The papillary pattern of the skin due to:
a. uneven thickness of the stratum corneum of the epidermis
b. the location of proliferative units in the epidermis
c.in the outlet of the ducts of the glands
d. papillary layer of the dermis

7.The mesh layer of the dermis contains:

a thick bundles of collagen fibers

b elastic fibers

c.in fibroblasts

d. striated muscle fibers

8.When the skin is damaged, the source of the epidermis cells are:

a. the ducts of the sweat glands

b .external root vaginas of hair follicles

c.into the intact epidermis

d.endothelium of capillaries

9 Skin glands:

a. provide thermoregulation

b. protect the skin from drying out

c. they secrete some metabolic products

d. participate in the synthesis of melanin

10.For thick skin is typical:

a. weak development of the stratum corneum

b. relatively thin dermis

c. covers the palms and soles

d. there are hair, skin glands

f.it consists of 4 layers

TOPIC: RESPIRATORY SYSTEM.
PC-9

I. Motivational characteristics of the topic.
The respiratory system unites a group of organs whose important function is to provide external respiration and gas exchange at the level of the lungs. Knowledge of the structure and histophysiology of the respiratory system is important for a doctor to understand the disorder of these functions and conduct targeted therapy. The development and application of modern methods of research and diagnosis of respiratory diseases, such as bronchoscopy, laboratory studies, are based on these data.

II. Targets:
1. Determine the respiratory organs at the microscopic level.
2. To study the microscopic and ultramicroscopic structure of the respiratory organs.
3. Explain the role of structural components of the airway wall and the respiratory Department in the implementation of respiratory functions of the lungs.
4. To identify structural elements aerogematiceski barrier on the submicroscopic level.

III. The required initial level of knowledge.
a) from the previous topics
1. Structure of the scintillating epithelium.
2. Structure of hyaline cartilage.
3. Structure of exocrine glands.

b) from the material of the current topic
1. Sources of development of the respiratory system
2. Microscopic and ultramicroscopic structure of the nasal cavity, larynx, trachea.
3. The air-bearing part of the lung. Features of the structure of the bronchial tree.
4. Respiratory Department of the lung. The pulmonary acinus.
5. The structure aerogematiceski barrier.

IV. Information part.
The trachea is a hollow tubular body composed of mucosa, submucosa, fibrous-cartilaginous, adventitia shells. The mucous membrane is lined with a multi-row prismatic ciliated epithelium consisting of ciliated, goblet-shaped, endocrine and basal cells. Under the epithelium is its own plate of the mucous membrane, consisting of loose fibrous connective tissue. The submucosal base is a loose connective tissue that passes without sharp borders into the dense connective tissue of the supracondyle. The fibrous-cartilaginous membrane consists of 16-20 open hyaline cartilage rings connected by bundles of smooth muscle cells. The adventitial membrane consists of loose fibrous connective tissue.
The lung consists of the airway system-the bronchial tree and the alveolus system - the respiratory Department. The bronchial tree includes the main bronchi, extrapulmonary lobe bronchi (large, 1st order), zonal extrapulmonary (2nd order bronchi), segmental, sub-segmental (medium caliber), small caliber and terminal (final) bronchioles. Changes in the structure of the bronchi with a decrease in caliber occur in each shell. The mucosa changes both the character of the epithelium (multi-row turns into a single-row) and the cellular composition. In its own plate, the number of muscle fibers gradually increases, which form a muscle plate in the small bronchi. In the submucosa, the glands gradually disappear, and then at the level of the small bronchi, the shell itself disappears. The fibrous-cartilaginous membrane undergoes changes at the level of each caliber, turning from closed hyaline rings into single Islands of hyaline, and later elastic tissue, and then disappears altogether. The adventitial shell is preserved throughout, gradually passing into the interlobular and interlobular connective tissue.

The respiratory Department has its structural unit acinus, which is a system of alveoli located in the wall of the respiratory bronchiole, alveolar passages and sacs that carry out gas exchange between the blood and air of the alveoli. Acinus includes respiratory bronchioles of the 1st, 2nd, and 3rd orders, alveolar passages that end in two alveolar sacs consisting of alveoli. The alveola is an unclosed vesicle lined from the inside with alveolocytes of the 1st, 2nd, and 3rd types and alveolar macrophages. Aerogematiceski barrier (the barrier between blood and air) provides gas exchange, the thickness is about 0.5 μm.
V. objects of study.

a) micro-products

1. Trachea (hematoxylin-eosin stain)

2. Lung (hematoxylin-eosin stain)

b) electronic messages.

No. 449.

VI. Learning activity.

1.On the "Trachea" micropreparation, find and draw the tracheal shells: mucous (I), submucosal (II), fibrous-cartilage (III), adventitial (IV). The mucous membrane is lined with a multi-row scintillating epithelium (1), under which there is a proper plate of connective tissue (2). In the submucosa, the terminal divisions of the mixed glands are located in groups (3). The submucosal layer passes into the supra-cartilage (4), followed by a wide belt of hyaline cartilage (5), which forms a semicircle. The gap between the ends of the cartilage semicircles is replaced by muscle tissue (6). In the adventitial sheath, there are blood vessels (7) and nerves (8) in the loose connective tissue.

2.On the micro-preparation "lung" find and draw the middle bronchus (1), the cartilaginous skeleton of which is represented on the preparation by separate plates of hyaline cartilage (2). The middle bronchi is lined with a multi-row scintillating epithelium (3), which is underlain by a thin own plate of the mucous membrane (4), which has a continuous layer of smooth muscles (5). The next submucosal layer (6) has more mucous glands (7). The fibrous membrane (8) passes into the interalveolar connective tissue of the lung (9). The majority of small bronchi (10) on a cross section has a stellate lumen formed due to the reduction of smooth muscles embedded in their wall, collecting the bronchial mucosa in high folds. The bronchus is lined with a single-layer cubic epithelium (11). Behind its own shell is an annular layer of smooth muscles (12). There is no cartilage backbone in the small bronchi. The respiratory section of the lung begins with respiratory bronchioles (13), which are lined with cubic epithelium (14). Respiratory bronchioles continue into alveolar passages (15) ending in alveoli (16).

3.Mark the drawings.

VII. Control question:
1. General plan of the structure of the respiratory system.
2. Structure of the trachea.
3. Features of the structure of the air-bearing Department of the lungs.
4. How does the structure of the bronchi change with the change in the air-carrying part of the lungs?
5. Respiratory Department of the lungs, its components, their structure.
6. Aerogematiceski barrier, its components, importance.

VIII. Learning objective.
1.In emphysema (disease) of the lungs, the lungs are not sufficiently collapsed when exhaling. What are the structural components of the respiratory damaged?
2.When inhaling air polluted with dust, foreign particles enter the Airways and alveoli. Which airway cells are involved in air purification and how?
3.In bronchial asthma, suffocation attacks are caused by spasms of smooth muscle cells in the intra-pulmonary bronchi. What kind of bronchial tubes are used primarily? What structural elements of the bronchi cause their spasm?
4.When Smoking for a long time or breathing dusty air, dust and smoke particles accumulate in the tissues of the lung and regional lymph nodes, so that the color of these organs changes (from pink to gray). What happens to dust and smoke particles when they enter the lumen of the alveoli and how do they end up in the regional lymph nodes?
5. With prolonged Smoking, the structure of the alveolar epithelium changes dramatically until its death. The surfactant is damaged, and breathing is sharply disrupted. What is the reason for this?
IX. The topics of structural abstracts.
1. Surfactant complex.
2. Alveolar macrophages.
3. Endocrine cells of the Airways.

INDEPENDENT WORK
I.THE STUDENT SHOULD KNOW:

1.Anatomical, microscopic and ultramicroscopic structure of the respiratory organs. 2.The role of structural components of the airway wall and the respiratory Department in the implementation of respiratory functions of the lungs. 3.Structural elements aerogematiceski barrier at the submicroscopic level	1.History: textbook / edited by Yu. I. Afanasiev, N. A. Yurina. - 5th ed., pererab. and add. - M.: Medicine, 2006. 2.Histology: textbook / Under the editorship of E. G. Ulumbekova, J. A. Chelysheva. - 2nd ed., pererab. and add. - M.: GEOTAR-MED, 2009. 3.Methodological guide for students in histology. Part 2. L. A. Akoeva, L. A. gireeva, L. S. Tabolova, and others. Vladikavkaz, 2008. 4.Age and histology. Respiratory system. Respiratory system. Methodological guide for students of medical, pediatric, preventive medicine and dental faculties. L. A Akoeva., L,A, Gireiev, L. S. Tabolov. Vladikavkaz, 2011.

III. THE STUDENT MUST BE ABLE TO:

1.	Determine the respiratory organs and their components at the microscopic level.
2.	Differentiate the components of the air-carrying and respiratory sections of the lung.

III. Tasks to prepare for the lesson:

Task # 1. Fill in the tables.

1.Features of the fibrous-cartilaginous lining of the bronchi.

Fibrous-cartilaginous membrane	trachea and main bronchi	
	large bronchi	
	medium-sized bronchi	
	small bronchi	

#2. Features of the structure of the middle bronchus

Epithelium	
Muscle plate of the mucous membrane	
Glands of the submucosa of the	
Fibrous-cartilaginous membrane	

Task 2. Fill in the table.

The alveola of the lung contains:

Name of the cell.	Structural feature.	Function

Task 3. Fill in the table. «Surfactant»

Name of the phase.	Location.	Composition.	Source of education.	Functions
Pituitary				
Membrane phase				

Task 4. Make 2-3 test tasks based on the sample.
Which cells form the surfactant?
1. Alveolocytes of the 2nd type (secretory).
2. Mesenchymal cells of the bronchi.
3. Respiratory alveolocytes.
4. Alveolar macrophages.
IV. Questions for self-monitoring:
1. Morphological and functional characteristics of the respiratory system. Respiratory and non-respiratory functions.
2. General plan of the structure of the respiratory system.
3. Structure and function of the trachea.
4. Features of the structure of the air-bearing Department of the lungs.
5. How does the structure of the bronchi change with the change in the air-carrying part of the lungs?
6. Respiratory Department of the lungs, its components, their structure.
7. Aerogematiceski barrier, its components, importance.

TEST YOURSELF:
CHOOSE ONE CORRECT ANSWER
1. What prevents the alveoli from sticking together when you exhale?
a. the basal membrane.
b. alveolocytes.
c. the surrounding blood capillaries.
d. surfactant.

2. How thick is aerogematiceski barrier?
a. 5 nm.
b. 0.5 microns.
c. 15 microns,.
d. 0.5 mm.

3.Airways include everything except
a. nasal cavities
b. trachea
c. bronchial tree
d. respiratory bronchioles
f. nasopharynx

4.In the submucosal base of the trachea are located:

a. simple protein glands

b. complex protein-mucosal glands

c. complex protein glands

d. complex mucosal glands

f. simple protein-mucosal glands

5.Determine the correct branching sequence of the bronchial tree:

a. main bronchi - zonal bronchi-lobar bronchi-segmental bronchi - sub-segmental bronchi - small bronchi - terminal bronchioles

b. main bronchi - lobar bronchi-segmental bronchi-zonal bronchi - sub-segmental bronchi - small bronchi - terminal bronchioles

c. main bronchi - zonal bronchi-lobar bronchi-small bronchi-segmental bronchi - sub-segmental bronchi - terminal bronchioles

d. main bronchi - lobar bronchi-zonal bronchi-segmental bronchi - sub-segmental bronchi - small bronchi - terminal bronchioles

SELECT THE CONDITION UNDER WHICH THIS STATEMENT IS TRUE

6. In which structures of the listed, there is a gas exchange between alveolar air and blood?

a. small bronchi.

b. the terminal bronchioles.

c. respiratory bronchioles.

d. alveolar passages.

f. the alveolar sacs.

7. What happens to the inhaled air in the Airways of the respiratory system?

a. cleaning.

b. warming.

c. humidification.

d. gas exchange with blood.

8. What are the shells of the tracheal wall?

a. mucosa.

b. submucosal

c. muscle.

d. fibrous-cartilaginous.

f. the adventitia.

e. serous.

9. Than aerogematiceski formed a barrier of light?

a. nuclear-free areas of respiratory alveolocytes.

b. non-nuclear portions of the endothelial cells of adjacent blood capillaries.

c. the common basal membrane of alveolocytes and blood capillaries.

d. alveolocytes of type II.

10. What role does the surfactant alveolar complex play?

a. trophic.

b. prevents the alveoli from falling off when exhaling.

c. prevents the penetration of microorganisms from the inhaled air through the wall of the alveoli.

d. prevents blood plasma from escaping from the surrounding capillaries into the alveoli.

MODULE 4
Targets.
1. Show knowledge of theoretical material on the studied topics.
2. Be able to determine and differentiate histological structures of tissues in micro-preparations.
3. Solve situational problems and tests.
4. Show knowledge in defining electronograms.

Control question:
1. General characteristics of hematopoietic organs and their classification.
2. Structure, localization, features of postembryonic hematopoiesis of the red bone marrow.
3. Thymus, structure, localization, features of hematopoiesis, functions. Age-related and accidental thymus involution.
4. Localization, structure and function of lymph nodes.
5. Features of blood circulation, localization, structure, functional value of the spleen.
6. The concept of organs of the endocrine system and endocrine cells of non-endocrine organs. Connection of the nervous and endocrine systems.
7. Functional classification of endocrine glands. Hypothalamic-pituitary system.
8. Neural secretory nuclei of the hypothalamus. Neurohormones, their effect on the body.
9. General morphofunctional characteristics of the pituitary gland, its hormones.
10. Features of the structure of the cortical and cerebral substances of the adrenal gland, its hormones.
11. Thyroid. Structure, localization, hormones and their role.
12. Microscopic and ultramicroscopic structure of the parathyroid glands and their role in the body.
13. General plan of the skin structure. Skin function.
14. Skin derivatives: sweat and sebaceous glands, their structure, localization, types of secretion.
15. Hair, hair types, structure, role of the hair bulb.
16. General plan of the structure of the respiratory system.
17. Structure of the trachea.
18. Features of the structure of the air-bearing Department of the lungs.
19. How does the structure of the bronchi change with the change in the air-carrying part of the lungs?
20. Respiratory Department of the lungs, its components, their structure.
21. Aerogematiceski barrier, its components, importance.

Control micro-products:
1. Thymus (hematoxylin-eosin stain)
2. Lymph node (hematoxylin-eosin stain)
3. Spleen (hematoxylin-eosin stain)
4. Cat's pituitary gland (color hematoxylin-eosin).
5. The adrenal gland (color hematoxylin-eosin).
6. The thyroid gland (color hematoxylin-eosin).
7. Parathyroid gland (color hematoxylin-eosin).
8. The skin of a human finger. "Thick skin" (color hematoxylin-eosin).
9. Skin with hair. "Thin skin" (hematoxylin-eosin color).
10. Trachea (hematoxylin-eosin stain)
11. Lung (hematoxylin-eosin stain)

Test task.