ЛД-21ИН

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»**

Part I

1st year student _ _ _ _ _ _ group

medical faculty

TOPIC: CALL. NON-CELLULAR STRUCTURES.
PC-5

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 (H_2O, CO_2 , O_2) 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-5

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-5

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-5

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-5

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-5

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.

MODULE LESSON 1

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-5

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-5

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-5

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-5

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 and functional differences..	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. 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-5

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)

TOPIC: EMBRYOLOGY. PERIODS OF EMBROGENESIS. STAGES OF EMBRYOGENESIS PC-5

I. Motivational characteristics of the topic.

The study of the embryonic development of mammals and humans makes it possible to find common features in the embryogenesis of animals and humans and, at the same time, to establish the characteristics of human development. The importance of the processes of fertilization, cleavage, implantation, gastrulation, as well as the development of extraembryonic organs is of great medical importance. It makes it possible to comprehend and evaluate the entire cycle of biological phenomena accompanying pregnancy and fetal development. Rational observation of pregnant women, management of childbirth is impossible without deep knowledge of embryology.

II . Target tasks.

1.To study the structure of male and female reproductive cells of mammals and humans.
2.To carry out a comparative characteristic of the processes of spermatogenesis and ovogenesis.
3. Understand the features of human embryonic development in comparison with other animals.

4. Show knowledge of the essence of the periods of human embryogenesis.
5. To study the features of the processes of histogenesis and organogenesis.

III . The required initial level of knowledge.

a) from the previous topics
1.The structure of germ cells
2. The essence of spermatogenesis and ovogenesis

b) from the material of the current topic
1. Features of the structure of male and female germ cells
2.The essence of spermatogenesis and ovogenesis
3. The main stages of embryogenesis
4.The concept of extraembryonic and embryonic material
5. Organogenesis and Histogenesis
Electronograms
No. 541, 542, 558-562.

IV . Objects of study

a) demonstration preparations
1.Crushing of the frog egg cell (hematoxylin-picrofuchsin staining)
2.Sagittal incision of a five-week-old human embryo (stained with hematoxylin-eosin)
3.Ovary (stained with hematoxylin-eosin)

V . Informational part.

Spermatozoa have a flagellate shape and are capable of active movement. They distinguish between the head, neck, body and tail. The sperm head contains a dense nucleus surrounded by a thin layer of cytoplasm. The nucleus contains a haploid set of chromosomes containing DNA, RNA, and histones. From above, the sperm head is covered with a cap, in which the acrosome is located. The acrosome contains the enzyme hyaluronidase. The cap and acrosome are derivatives of the Golgi complex. The sperm neck contains the proximal centriole, which plays an important role in the division of the fertilized egg. The sperm body contains mitochondria, and glycogen stores are located here. The tail of the sperm contains an axial filament, which is surrounded by a small amount of cytoplasm containing the enzyme adenosine triphosphatase. The speed of movement of the sperm is 2 - 3 mm per minute.

The female reproductive cell - the ovum - has a rounded shape and does not have the ability to move independently. The oocyte contains a large nucleus with a haploid set of chromosomes, a nucleolus and an ooplasm, in which the nutrient material in the form of the yolk is located. The size of mammalian oocytes is 50-150 microns. The ovum contains mitochondria, the lamellar Golgi complex, and an underdeveloped endoplasmic reticulum. The ovum lacks a centrosome. The ovum is covered with a primary membrane, which is formed by the hardening of the outer layer of the cytoplasm and a secondary membrane formed by follicular cells called the zona pellucida. Its outer part, consists of acidic mucopolysaccharides, is secreted by follicular cells. The inner zone, consisting of neutral mucopolysaccharides, is formed by the oocyte. Follicular cells perform a trophic function.

In mammals and humans, in connection with intrauterine development, the egg cell became secondary oligolecitic (the amount of yolk is small), isocytal (uniform distribution of the yolk).

In embryogenesis, the following stages are distinguished: fertilization, cleavage, gastrulation, separation of the embryo from extraembryonic material, histogenesis, organogenesis.

Fertilization is the fusion of male and female germ cells. In the process of fertilization, three phases are distinguished: 1. distant interaction and rapprochement of gametes, 2. contact interaction and activation of the egg, 3. The entry of the sperm into the egg and subsequent fusion - syngamia.

Cleavage is the sequential mitotic division of the zygote into blastomeres without their subsequent growth to the size of the maternal. In humans, fragmentation is complete, asynchronous. As a result of cleavage, a blastocyst is formed, consisting of dark and light blastomeres. An embryoblast is formed from dark blastomeres, and a trophoblast from light blastomeres.

Light blastomeres split faster and surround dark blastomeres inside the embryo with one layer from the surface. In the process of further development, the body of the embryo, the mesoderm of the chorion, the amniotic membrane and allantois, and from the trophoblast - the epithelium of the chorionic membrane arise from the embryoblast, due to which the connection of the embryo with the mother's body is established.

During the cleavage period, the embryo moves to the uterus due to the contraction of the walls of the fallopian tubes and the ciliated movements of the epithelium of the mucous membrane. At 7-7.5 days after fertilization, the blastocyst enters the uterine cavity. During this period, the nutrition of the embryo is carried out by the enhanced absorption of the secretion of the uterine glands by the cells of the trophoblast. As a result, a bubble appears, the cavity of which is filled with liquid. The embryoblast is located in the cavity, attaching itself to the trophoblast from the inside. This stage of development of the embryo is called the blastocyst.

Implantation - the introduction of the embryo into the wall of the uterus begins from the 7th day and lasts 40 hours. There are two stages of implantation: adhesion and invasion.

Gastrulation is the formation of three germ layers.

Trophoblast cells actively multiply and from a single-layer trophoblast turns into a two-layer one. The inner layer retains the cellular structure and is called cytotrophoblast; moving into the outer layer, the cells merge and form a symplast. This layer is called syncytrophoblast. Syncytotrophoblast has a high enzymatic activity, releasing hydrolytic enzymes into the surrounding endometrial tissue. The trophoblast forms numerous outgrowths - primary villi. As a result, the surface of contact of the embryo with the endometrium and the blood of the mother's body increases. After the blastocyst stage, the gastrulation process begins. In humans, gastrulation proceeds through delamination and immigration. The first phase of gastrulation in the human embryo occurs by delamination. The embryoblast splits into two layers: the upper layer of cells forms the future ectoderm, the lower one - the future endoderm. Then the endoderm, curling up and growing together, forms an endoblastic or yolk vesicle.

The development of extraembryonic structures begins with the formation of a trophoblast, an amniotic vesicle and a yolk vesicle. Following this, process cells are evicted from the embryonic scutellum, loosely filling the cavity of the embryonic bladder, heading to the trophoblast - the extraembryonic mesoderm. The latter, expanding, surrounds the amniotic and yolk vesicles, transforming them, respectively, into the amnion and yolk sac. The extraembryonic mesoderm, located under the trophoblast, forms the chorion together with it. From the walls of the yolk and amniotic vesicles in the direction of the trophoblast, a strand of cells of the extraembryonic mesoderm appears - the amniotic leg. This is the mesenchyme of the future allantois, along which the vessels of the embryo will later grow to the chorion.

On the 15th day of development, an unpaired outgrowth is formed from the wall of the intestinal tube, heading to the amniotic leg - allantois. It does not reach the chorion, but creates a bridge over which blood vessels grow from the body of the embryo. The latter, having penetrated the chorion, enter each of its villi. From this moment, the chorionic villi are called secondary. The formation of a vascular connection accelerates the development and growth of the embryo.

An ectoblastic or amniotic vesicle arises from the ectodermal layer by moving the cells apart with liquid. Including, where the cells of the amniotic vesicle come into contact with the cells of the yolk vesicle, an embryonic flap is formed - a structure from which the body of the embryo, extraembryonic mesoderm and allantois will develop.

The embryo itself during this period is represented by the embryonic scutellum and consists of two embryonic layers - the ectoderm and the endoderm.

On the 15th day of intrauterine development, the second phase of gastrulation begins, proceeding through immigration, which leads to the formation of the third germ layer - the mesoderm and then the complex of axial organs. In this case, as a result of the multiplication of ectoderm cells and their movement towards the future posterior end of the embryonic scutellum, two strands of cells are formed. Cell strands are found at the posterior end of the embryonic scutellum, turn to the anterior end and in the middle of the posterior section of the embryonic scutellum form a thickening - the primary strip.

At the anterior end of the primary strip, an accumulation of cells is formed - the head nodule. The cells of the primary stripe submerge under the ectoderm, settle in the space between the ecto- and endoderm, and form the third germ layer, the mesoderm.

At the top of the head nodule, a protrusion appears - a fossa. The fossa gradually deepens and, breaking through the ectodermal layer, turns into a neurointestinal canal. The cellular material of the head nodule migrates into the space between the ecto- and endoderm to the anterior end of the embryonic scutellum, forming the chordal process. ... By the 17-18th day of embryonic development, the period of formation of axial organs is completed.

The main features of the early stages of development of the human embryo:

- asynchronous type of complete cleavage and the formation of light and dark blastomeres
- early isolation and formation of extraembryonic organs
- early formation of the amniotic vesicle and the absence of amniotic folds
- the presence of two phases of gastrulation - delamination and immigration and the formation of extraembryonic organs
- interstitial implantation

From the 20th day of intrauterine development, the embryo begins to separate from the extraembryonic organs. This occurs through the formation of the trunk fold, which includes ectoderm, splanchnatom and endoderm., Segmentation and differentiation of the mesoderm. This period is called the somite or segmentation period.

The germ layers are the embryonic sources of tissue development - histogenesis, from the totality and interaction of which organs develop - organogenesis.

Differentiation of germ layers:

Germ leaf name	Embryonic rudiments	Tissue derivatives
Ectoderm	Neural tube	Neurons and neuroglia of the central nervous system and retina

	Cutaneous ectoderm	Epidermis and its derivatives
		Oral epithelium
		Anal epithelium of the rectum
		Tooth enamel
		Vaginal epithelium
	Prechordal plate	Epithelium of the oral cavity and esophagus
		Epithelium of the trachea, bronchi and lungs
Endoderm	Intestinal	Epithelium of the liver and pancreas
		Epithelium of the stomach and intestines
		Epithelium of the glands of the stomach and intestines
Mesoderm	Somite:	
	dermatome	Dermis of the skin
	sclerotome	Skeletal tissue
	myotome	Striated skeletal muscle tissue
	nephrogonotome	Renal epithelium
		Epithelium of the vas deferens
	Paramesonephral canal	Epithelium of the uterus and oviduct
	splanchnot	Muscle tissue of the heart
		Adrenal cortex
		Mesothelium of serous membranes
	Mesenchyme	Blood cells
		Blood vessels
		Connective tissue
		Smooth muscle tissue
		Microglia

VI . Educational tasks.

1. Using the lecture tables, consider and sketch the "Embryo at the 7.5 days stage." Find trophoblast (I), blastocyst cavity (II), embryoblast (III). The embryoblast splits into two sheets - the epiblast (1) facing the trophoblast and the hypoblast (2) facing the blastocyst cavity. The embryoblast is surrounded by cells of the extraembryonic mesoderm (3), which are involved in the formation of the amniotic vesicle (4). Trophoblast enzymes destroy the uterine epithelium (5), the embryonic material is immersed in the lamina propria (6) of the endometrium of the uterus, containing the uterine glands (7) and rich in blood vessels (8).
2. Using the lecture tables, consider and sketch the "Fetus at the 15-day stage." Find the embryo (1) immersed in the lamina propria of the endometrium (2), the endometrial epithelium (3) is restored at this stage. The embryo is represented by two layers - epiblastoma (4) and hypoblastoma (5). The trophoblast (6), together with the underlying mesoderm (7), forms the chorion (8). In the embryonic material, the amniotic vesicle (9) and the yolk vesicle (10) are separated. This part is attached to the chorion using an amniotic stem (11).
3. Designate the pictures.

VII . Control questions.

1.Characteristics of germ cells. Their importance in the development process.
2.The structure of the sperm.
3.Female reproductive cell. Features of its structure.
4.The role of the cortical zone of the egg for further development.
5.Types of oocytes depending on the number and nature of the location of the reserve trophic material.
6.The embryonic period. Its definition and characteristics.
7.Stages of embryogenesis.
8.The biological essence of fertilization.
9.Zygote is a stage of a unicellular organism.
10.Types of crushing.
11.Crushing as a variety of cell division and its bio - logical features. The relationship between the type of cleavage and the type of ovum.
12.Gastrulation. The biological essence and morphology of the gastrulation process.
13.When, where and in what way does the 1st phase of gastrulation take place? What is formed as a result of this phase.
14.When, where and in what way does the 2nd phase of gastrulation take place? What is formed as a result of this phase.
15.Germ layers and their differentiation.
16.How does mesoderm differentiate? How many pairs of somites are formed?
17.Histogenesis and organogenesis.

VIII . Educational tasks.

1.The histological specimen shows eggs at different stages of development. With an increase in the size of the oocytes, they accumulate a small amount of yolk inclusions, evenly distributed throughout the cytoplasm. Determine what type of egg and what kind of animal they are.
2.The electronogram shows cross sections of spermatozoa.
On one, axial filaments surrounded by mitochondria are well traced, on the other, only the centriole is visible. Name which parts of the cell are shown in the photographs.
3. The electronograms show male and female germ cells. As by the composition of the organelles, one can distinguish an egg from a sperm.
4. The figure shows the eggs of the lancelet, frog, chicken and humans. To what type of oocytes in terms of the number and distribution of the yolk, each of them belongs.
5. The sex cell is surrounded by two membranes: a lustrous and a radiant crown. Name this cell. What cells are involved in the formation of these membranes?
6. A cavity is formed in the human embryo and differentiation of blastomeres occurs. What stage of development is the embryo at? Where is this happening? What formations are the result of differentiation?
7. The beginning of human embryo implantation was registered. At what stage is the embryo, what is its age in the normal course of pregnancy?
8. "The man was born in a shirt." What "shirt" is said in the proverb and what is the source of the development of the epithelium from the inside of the lining?
9. The cellular material of the embryoblast of the human embryo becomes bilayered. What is the mechanism of the formation of layers, the stage of embryogenesis, the age of the embryo?
10. In the human embryo, the laying of axial organs began. What is the age of the embryo?
11.Two pregnant women suffered from a toxic form of flu. the first of the cases was at the 2nd week of pregnancy, the second at the 12th week of pregnancy. It soon became clear that the first woman's embryo died, while the second woman's pregnancy was preserved and the fetus was alive. Why did the embryo die in the first case? Why did the fetus survive in the second case?
13. In the study of the amniotic fluid obtained as a result of amniocentesis (puncture of the amniotic membrane), cells were found in the nuclei of which there is sex chromatin (Barr's little body). What can its presence indicate?

IX . Topics of abstract messages.

1. Methods and results of quantitative analysis of DNA in the nuclei of sex and somatic cells.
2.Sex chromatin.
3.Submicroscopic organization of germ cell chromosomes.
4.Participation of oocyte organelles in yolk synthesis.
5.Transplantation of somatic cell nuclei into an oocyte.
6. Fertilization and fragmentation of the human egg.
7.Determination and differentiation of developmental processes.
8.Modern genetic theory of the development of the embryo.

INDEPENDENT WORK

I.STUDENT SHOULD KNOW:

1.Features of the structure of male and female germ cells 2.The essence of spermatogenesis and ovogenesis	1.Histology: textbook / Ed. Yu.I. Afanasyeva, N.A. Yurina. - 5th ed., Rev. and add. - M .: Medicine, 2006. 2.Histology: textbook / Ed. E.G. Ulumbekova, Yu.A. Chelysheva. - 2nd ed., Rev. and add. - M .: GEOTAR-MED, 2009. 3. Methodological manual for students in histology. Part 2. L.A. Akoeva, L.A. Gireyeva, L.S. Tabolova et al. Vladikavkaz, 2008. 4. Embryology. Study guide. L.A. Akoeva., L., A. Gireyeva, L.S. Tabolova et al. Vladikavkaz, 2008.

II. A student should be able to:
1.Determine spermatozoa and eggs in micropreparations
2. Using tables, determine the early stages of embryo development.
3. Identify germ layers and extraembryonic organs.

III . Tasks for preparing for the lesson:
Task number 1. Complete the sentence:
Male reproductive cell - ……., Consists of:

one.
2.
3.

Task number 2. Fill in the tables.

In human embryogenesis, there are 3 periods and 5 stages:

No.	Period name	Timing	The main events
one			
2			
3			
	Stage name	Timing	The main events
one			
2			
3			
four			
five			

Fertilization

Phases	characteristic
Approximation and distant interaction of germ cells	
	numerous spermatozoa bind to the membranes of the oocyte. At the same time, due to the beating of the sperm flagella , the oocyte begins to rotate around its own axis. In the bound spermatozoa , an acrosomal reaction develops, acrosomal enzymes are released that dissolve the zona pellucida at the site of the passage of the sperm .
Penetration of the sperm into the oocyte II	

Task number 3. Fill in the tables.

Splitting up.

Localization	The nature of crushing

	Crushing takes place in ... and by the end its embryo reaches
	In humans, fragmentation: 1. 2. 3.

Task number 4.
Complete the sentence:
A blastocyst is ... is formed through .... days and is in ...

Implantation

Implantation is ...

Start	duration	stages	Stage characteristics

Task 5. Complete the sentence:
1. Gastrulation in a person takes place in two phases.

a) The first phase takes place on… day - simultaneously with …….., carried out by ……

b) The second phase occurs in the period from… to… days, carried out by….

Task number 6 . Fill the table.

Histogenesis and organogenesis

Germ leaves	Embryonic rudiments	Organ tissue

IV . Questions for self-control:

1. How long does an egg retain the ability to fertilize?
2. How long does sperm retain their fertility?
3.What phases does fertilization include? When and where does it take place?
4.At what period of embryonic development does cleavage occur? Where does it take place and how long does it take? What type of fragmentation does a person have?
5.At what stage of development are blastomeres formed? How light blastomeres differ from dark ones. What do they form?
6.What is implantation? When and where does it take place? What stages of implantation do you know? 7.What is the difference between the histiotrophic type of nutrition and the hematotrophic one? 8.Gastrulation. The biological essence and morphology of the gastrulation process.
9. Types of gastrulation. Characteristics of the 1st and 2nd phases of gastrulation.
10.Germ layers and their differentiation.
11.Histogenesis and organogenesis.

Task 3. Make 2-3 test tasks according to the sample.

CHOOSE ONE CORRECT ANSWER

1. Name the initial stage of embryogenesis:
a. Splitting up.
b. Gastrulation.
c. Fertilization.
d. Organogenesis.

2. What is the period of transition from the unicellular stage of development to multicellular:
a. Fertilization.
b. Gastrulation.
c. Histogenesis.
d. Crushing.

3. What type of cleavage is characteristic of the human zygote?
a. Full uniform.
b. Complete uneven (asynchronous).
c. Partial.

4. What is the usual time of implantation in humans after fertilization?
a.1-3 days

b. 3-5 days
c. 5-6 days
d.7-8 hours
f. 10-12 days

5. When does the embryonic end and the fetal period of fetal development of a person begin?
a.At the end of the first month.
b. At the beginning of the third month.
c. At the end of the third month.
d. At the beginning of the fourth month.

CHOOSE UNDER WHAT CONDITIONS THIS STATEMENT IS CORRECT

6. Name the main properties of mature germ cells:
a. Differentiated.
b. Diploid.
c. Haploid.
d. Undifferentiated.
e. Not capable of division.

7. Indicate what is formed during the differentiation of the embryonic mesoderm?
a. Somites.
b. Epithelium of the gastrointestinal tract.
c. Splanchnotom.
d. Nephrogonatom **.**
e. Nerve tissue

8. What are the derivatives of the embryonic endoderm?
a. Yolk sac epithelium.
b. Stomach epithelium.
c. Intestinal epithelium.
d. Glands of the gastrointestinal tract.
e. Allantois epithelium.
f. Excretory system.

9. Name the process by which the fetus establishes a connection with the mother's body.
a.Gastrulation.
b. Implantation.
c. Histogenesis.
d. Fertilization.
e. Placentation.

10. Human egg cell.
a.Telolecital.
b.Secondary oligolecital.
c.Isolecital.
d. Surrounded by a shiny shell.
e. Surrounded by follicular cells.

TOPIC : EMBRYOLOGY. EXTRAORDINARY ORGANS.

I. Motivational characteristics of the topic.

Knowledge of embryology is needed by the future doctor for the prevention of fetal anomalies and malformations. And also to prevent the adverse effects of environmental factors and everyday life on the course of pregnancy.

II. Target tasks.

1.Examine the extraembryonic organs of a person.

2.Have a clear understanding of the structural components of the blood-placental barrier.

III . The required initial level of knowledge.

a) from the previous topics
1.Stages of embryonic development of mammals and humans
2.Sequence and morphological features of the development of extraembryonic organs in mammals and humans
b) from the material of the current topic

Sources of the formation of the placenta in humans
1.The role of the placenta in the development of the embryo
2.The essence of differentiation processes during the period of histo- and organogenesis.

IV . Informational part.

Extraembryonic (provisional) organs include: yolk sac, amnion, allantois, chorion, placenta. Provisional organs develop in the process of embryogenesis outside the body of the embryo and perform various functions that ensure the growth and development of the embryo. The human embryo is characterized by a strong development of the amnion, chorion and weak development of the yolk sac and allantois.
The development of extraembryonic structures begins with the formation of a trophoblast, an amniotic vesicle and a yolk vesicle. Following this, process cells are evicted from the embryonic scutellum, loosely filling the cavity of the embryonic bladder, heading to the trophoblast - the extraembryonic mesoderm. The latter, expanding, surrounds the amniotic and yolk vesicles, transforming them, respectively, into the amnion and yolk sac. The extraembryonic mesoderm, located under the trophoblast, forms the chorion together with it. From the walls of the yolk and amniotic vesicles in the direction of the trophoblast, a strand of cells of the extraembryonic mesoderm appears - the amniotic leg. This is the mesenchyme of the future allantois, along which the vessels of the embryo will later grow to the chorion.
On the 15th day of development, an unpaired outgrowth is formed from the wall of the intestinal tube, heading to the amniotic leg - allantois. It does not reach the chorion, but creates a bridge over which blood vessels grow from the body of the embryo. The latter, having penetrated the chorion, enter each of its villi. From this moment, the chorionic villi are called secondary. The formation of a vascular connection accelerates the development and growth of the embryo.
The placenta is fully formed by the end of 3 months of intrauterine development, performing trophic, respiratory, excretory, barrier, protective, endocrine functions. In the placenta, the fetal (embryonic) and maternal (uterine) parts are distinguished .
The fetal part is represented by a branching chorionic plate, consisting of connective tissue covered with cyto- and syncytiotrophoblast. Branching villi, surrounded by gaps with blood, extend from the chorionic plate. The structural and functional unit of the formed placenta is the catheledon, formed by the stem villi and its secondary and tertiary villi.
The maternal part of the placenta is represented by the basal plate and connective tissue septa separating the catheledons from each other, as well as lacunae filled with maternal blood. The basal layer of the endometrium, a loose connective tissue, contains decidual cells rich in glycogen.
The blood of the mother and the fetus circulates through independent vascular systems and does not mix with each other. The hemochorionic barrier that separates both blood flows consists of the endothelium of the fetal vessels, the surrounding connective tissue vessels, and the epithelium of the chorionic villi.
In mammals, 4 types of placenta are distinguished : epitheliochorial, syndesmochorial, endotheliochorial, hemochorial. In humans, the hemochorial, discoidal placenta.

V . Objects of study.

a) micropreparations
1.Fetal part of the placenta (staining with hematoxylin - eosin)
2.Maternal part of the placenta (staining with hematoxylin - eosin)

VI . Study assignments.

1. On the micropreparation "Fetal part of the placenta" find and sketch the amniotic membrane (1), the chorionic plate (2) - loose connective tissue rich in blood vessels (3). Chorionic villi (4), immersed in blood gaps (5), extend from the chorionic plate deep into the placenta. The basis of the villi is the embryonic connective tissue (6), which contains a network of blood vessels (3). The surface of the villi is covered with a layer of chorionic symplast (7), under which another layer is preserved in the developing placenta - cytotrophoblast (8), which is no longer found in the mature placenta.
2. On the micropreparation "Maternal part of the placenta" find and sketch the basal plate (1), from which the placenta usually exfoliates from the uterine wall. The maternal part is represented by connective tissue (2), in which decidual cells are well defined (3). From the basal plate, protrusions protrude into the thickness of the placenta, forming incomplete septa, dividing the placenta into lacunae (4).

3. Designate the pictures.

VII . Control questions.

1. Extraembryonic human organs, time of occurrence, duration of functioning, role.
2. Types of placentas in mammals.
3. The structure and function of the human placenta.
4. Morpho-functional characteristics of the placental barrier.
5. The concept of critical periods. Critical periods in the development of the human embryo.

VIII . Educational tasks.

1.Injection of the urine of a pregnant woman to immature mice causes the latter to rapidly ripen ovarian follicles (an early clinical test for detecting pregnancy). What substance contained in urine determines this gonadotropic effect and where is it synthesized?

2. The child of the first months of life has a tolerance to a number of infectious diseases. What determines the immunity of a newborn?

3. The placental barrier is not completely impenetrable and therefore does not always prevent the penetration of substances and factors from the mother's blood to the fetus. What harm can a developing fetus, especially in the first half of pregnancy, cause from smoking, drinking alcohol or taking certain medications without medical supervision? What is the possible mechanism of action of these factors?

4. In the embryo of a person, the process of separating him from the provisional organs is recorded. The formation of what structure leads to this and what is the age of the embryo?

5. During human development, a yolk sac is formed, which does not contain the yolk. What is the function of this body?

INDEPENDENT WORK

I. A student should know:

1. Extraembryonic organs, their role. Sources of the formation of the placenta in humans 2. The role of the placenta in the development of the embryo	1.Histology: textbook / Ed. Yu.I. Afanasyeva, N.A. Yurina. - 5th ed., Rev. and add. - M .: Medicine, 2006. 2.Histology: textbook / Ed. E.G. Ulumbekova, Yu.A. Chelysheva. - 2nd ed., Rev. and add. - M .: GEOTAR-MED, 2009. 3. Embryology. Study guide. L.A. Akoeva., L.A. Gireyeva, L.S. Tabolova et al. Vladikavkaz, 2008. 4. Methodical manual for students in histology. Part 2. L.A. Akoeva, L.A. Gireyeva, L.S. Tabolova et al. Vladikavkaz, 2008.

II. A student should be able to:

1. To determine the provisional organs and their structural components on micropreparations and tables.

III.Tasks for preparing for the lesson:

Task number 1. Fill in the table "Provisional authorities".

Provisional organs	Components of provisional organs	Terms of operation	Functions

Task number 2. Fill in the table "Structure of the placenta"

Components	Based on what are formed	Components

Task 3. Make 2-3 test tasks according to the sample.
1. Name what structures are part of the fetal part of the placenta:
a.vessels of the fetus.
b. chorionic plate.
c. chorionic villi.
d. amniotic membrane adherent to the chorion.
f. endometrium.

IV. Questions for self-control:

1. What is the critical period of embryogenesis? What critical periods do you know and at what stages of embryogenesis do they occur?
2. What factors interfere with normal embryogenesis?
3. What forms the amniotic vesicle and yolk sac? What role do these formations play in the development of the embryo?
4.How does mesoderm differentiate? How many pairs of somites are formed?
5. What is the fetal part of the placenta represented by?
6.What is the role of the hemochorial barrier? How is he educated?
7.What type of placenta does a person have? How is it different from other types?
8.When does the placenta formation start? When does placenta formation complete? What are the functions of the placenta?
9.What does it mean: "The person was born in a shirt?" What is the role of this entity?
10.What extraembryonic organs are well developed in humans in the early periods of embryogenesis and what role do they play?
11.Why is there no immune conflict between mother and fetus?

CHECK YOURSELF:

CHOOSE ONE CORRECT ANSWER

1. What type is the human placenta?
a. multiple desmochorial placenta.
b. diffuse epitheliochorial placenta.
c. discoidal hemochorial placenta.
d.stripline endoteliohorialnaya placenta.

2. What functions does the amniotic membrane perform in mammals?
but. trophic.
b. respiratory.
in. excretory.
g. hematopoietic.
e. creating an aquatic environment for the embryo.

3. What functions does allantois perform in mammals?
a conducting blood vessels from the fetal body to the placenta.
b. gas exchange.
c. excretory.
d. hematopoietic.
f. creating an aquatic environment for the embryo.

4. Critical periods of human development cannot be attributed to:
a. gametogenesis
b. fertilization
c. splitting up
d. implantation
f. laying of the axial primordia of organs

5. What type of nutrition of the fetus in the development of chorionic villus in humans?
a. hematotrophic.
b. histiotrophic.
c. epitheliotrophic.

CHOOSE UNDER WHAT CONDITIONS THIS STATEMENT IS CORRECT

6. Indicate the functions of the human placenta:
a. trophic.
b. excretory.
c. endocrine.
d. protective.
f. provides a connection between the fetus and the mother's body.
e. production of amniotic fluid.

7 . Indicate which structures (tissues) are part of the placental (hematochorionic) barrier:
a. hemochorial space.
b. chorial (trophoblastic) epithelium.
c.connective tissue of the villi.
d. basement membrane.
e. the endothelium of the villus capillaries.

8. Name what structures are part of the fetal part of the placenta:
a. vessels of the fetus.
b. chorionic plate.
c. chorionic villi.
d. amniotic membrane adherent to the chorion.
f. endometrium.

9. What are the structures included in the umbilical cord?
a. extraembryonic amniotic epithelium.
b. mucous connective tissue.
c. umbilical arteries.
d. umbilical Vienna.
f. reticular tissue.

10. What are the structures that make up the secondary villi of the chorion?
a. cytotrophoblast.
b. plasmodiotrophoblast.
c. extraembryonic connective tissue.
d. reticular tissue.
e. blood vessels.