

THE MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
BLACK SEA STATE UNIVERSITY OF A NAME OF PETRO MOHYLA
MEDICAL INSTITUTE

Department of Medical Biology and Physics, Microbiology, Histology, Physiology and Pathophysiology

«APPROVED»

First vice-rector

 Ischenko N.M.

« » 2021

WORKING PROGRAM OF THE EDUCATIONAL DISCIPLINE

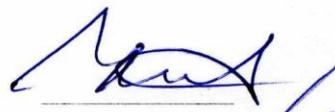
HISTOLOGY, CYTOLOGY AND EMBRYOLOGY

Specialty 222 «Medicine»

Developer Pshychenko V.V. 

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1. DESCRIPTION OF EDUCATIONAL DISCIPLINE

Characteristic	Characteristics of the discipline		
Name of the discipline	Histology, cytology and embryology		
Branch of knowledge	22 «HealthCare»		
Specialty	222 «Medicine»		
Specialization (if any)			
Educational program	Medicine		
High education level	Master		
Status of discipline	Normative		
Course of Study	I, II		
Academic year	2021-2022		
Semester numbers:	Full-time	Correspondence form	
	II, III		
Total ECTS credits / hours	8.5 credits (5,5 / 3,0) / 255 hours		
Course structure: <ul style="list-style-type: none"> - - lectures - - seminars (practical, laboratory, semigroup) - - hours of independent work of students 	Full-time	Correspondence form	
		36 hours (20/16)	
		93 hours (64/29)	
		126 hours (81/45)	
Percent age of classroom load	51%		
Language of instruction	English		
Interim control form (if any)	Total Modular Control (TMC)		
Form of final control	2nd semester - credit, 3rd semester - exam		

2. Purpose, tasks and planned learning outcomes

Purpose: Histology, cytology and embryology aims to study the microscopic and ultramicroscopic structure of the structures of the human body, their development and changes in various living conditions, students acquire deep knowledge of histology and use this knowledge in the process of further training and in professional activities to solve clinical problems, create a theoretical basis for students to master clinical disciplines (internal diseases, surgery, clinical pharmacology, pathological anatomy, etc.), integrate teaching with the main clinical disciplines, development of professional abilities for clinical thinking in students.

Task:

- * to study the molecular and structural foundations of the functioning and restoration of cells and their derivatives;
- * to study the basics of adaptation, reactivity and maintenance of homeostasis;
- * to determine of adaptive and regenerative capabilities of organs, taking into account their tissue composition, regulatory features and age-related changes;
- * to determine the phases of the cell life cycle, the ability of cells to proliferate, restore and function according to structural parameters;
- * to determine the histological elements and their structural components during light and electron microscopy;
- * to interpret patterns of human embryonic development, regulation of morphogenesis processes;
- * to determine critical periods of embryogenesis, malformations and anomalies of human development;
- * to interpret functional specialization (differentiation) and the state of cells according to structural features;
- * to interpret the sources of tissue development and histogenesis patterns;
- * to identify tissues with informative morphological characters, interpret their functional state and significance;
- * to interpret the general laws of the structural organization and functioning of organs and systems

Prerequisites for studying the academic discipline (interdisciplinary connections)

Histology, cytology and embryology as a discipline:

a) is based on the study of students of anatomy and physiology, medical biology, medical and biological physics, biological and bioorganic chemistry, foreign language and integrates with these disciplines;

b) lays the foundations for the study of clinical disciplines by students, which provides for the integration of teaching with these disciplines and the formation of skills to apply knowledge of histology, cytology and human embryology in the process of further study and professional activities;

Expected learning outcomes

As a result of studying the discipline, students have:

know:

- subject area of histology, cytology and embryology;
- patterns of cyto- and histogenesis, the structure and function of cells and tissues at the microscopic and submicroscopic level, the purpose of individual components of the cell;
- molecular and structural bases of functioning and restoration of cells and their derivatives;
- basics of adaptation, reactivity and maintenance of homeostasis;

- organization of tissues and features of their interaction in the composition of organs, conditions and mechanisms of tissue regeneration;
- adaptive and regenerative capabilities of organs;
- tissue composition of organs, features of regulation;
- age-related changes in cells, tissues, organs;
- structure of gametes, periods of embryogenesis and their patterns, critical periods of embryogenesis;
- patterns of tissue differentiation and regeneration;
- the role of the nervous, endocrine, immune systems of the body in the regulation of morphogenesis of cells, tissues and organs;
- processes of morphogenesis, patterns of human embryonic development;
- critical periods of embryogenesis, defects and anomalies of human development;

be able to:

- use microscopic instruments;
- study histological and embryological preparations under a light microscope;
- identify and describe electronic micrographs;
- make up a protocol describing the studied object;
- master the practical skills of working with a light microscope;
- diagnose histological preparations;
- explain the basic principles of organization of different tissues, their interaction.

Competences and learning outcomes in accordance with the academic and professional program, the formation of which is facilitated by the discipline (integral, general, special)

According to the requirements of the standard, the discipline ensures the acquisition by students the following competencies:

- integral (IC) – IC1 EPP:

IC1. Ability to integrate knowledge and solve complex specialized problems and problems in professional activity in the field of health care in the specialty "Medicine", or in the process of training involving research and / or innovation, in broad or multidisciplinary contexts, new or unfamiliar environments in the presence of incomplete or limited information, taking into account aspects of social and ethical responsibility.

- general (GC) - GC1 EPP:

GC1. The ability to abstract thinking, analysis and synthesis, ability to learn and master modern knowledge;

- professional (PC) – PC2, PC3, PC5, PC14 EPP:

PC2. The ability to determine the required list of laboratory and instrumental studies and evaluate their results;

PC3. The ability to establish a preliminary and clinical diagnosis of the disease;

PC5. The ability to determine the nature of nutrition in the treatment of diseases;

PC14. The ability to carry out sanitary-hygienic and preventive measures.

According to the educational-professional program, the expected program learning outcomes (PRS) include the skills of PRS1, PRS4, PRS12 EPP:

PRS1. Know the methods of analysis, synthesis and further modern learning. Be able to analyze information, make informed decisions, be able to acquire modern knowledge. Establish appropriate connections to achieve goals. Be responsible for the timely acquisition of modern knowledge.

PRS4. Know the types and methods of adaptation, principles of action in a new situation. To be able to apply means of self-regulation, to be able to adapt to new situations

(circumstances) of life and activity. Establish appropriate connections to achieve results. Be responsible for the timely use of self-regulatory methods.

PRS12. Evaluate information about the diagnosis in the conditions of a health care institution or its division, using a standard procedure, using knowledge about a human, their organs and systems, based on the results of laboratory and instrumental studies (according to list 4).

3. PROGRAM OF EDUCATIONAL DISCIPLINE

The educational process is organized according to the European credit transfer and accumulation system (ECTS).

The program of the discipline consists of three information blocks:

INFORMATION BLOCK 1 CYTOLOGY AND EMBRYOLOGY

Topic 1. Optical devices. Rules for working with a microscope. Special methods of research in cytology, embryology, histology. Introduction to the course of Histology, Cytology and Embryology. History of development of science. The emergence of histology, cytology and embryology as independent sciences. The value of the works of R. Hooke, A. Levenhuk, J. Purkinje, R. Brown, M. Schleiden for the creation of cell theory. T. Schwann's research. Cell theory as a fundamental generalization of biology. Elucidation of the microscopic structure of tissues and organs, creation of tissue classification.

Development of histology, cytology and embryology in Ukraine. The current stage of development of histology, cytology and embryology. Connection of histology with other sciences of medical and biological profile.

Basic principles of manufacturing specimen for light and electron microscopy, obtaining material (biopsy, needle puncture biopsy, autopsy). Fixation, dehydration, compaction of objects, making sections on microtomes and ultramicrotomes. Types of micropreparations are cut, smear, imprint, film, section. Coloring and contrasting of drugs. The concept of histological dyes.

Technique of microscopy in light microscopes. Special methods of light microscopy - phase contrast, dark field, luminescent, interference, laser scanning. Transmission and scanning electron microscopy. The concept of histochemistry, radioautography, immunocytochemistry. Congratulatory research methods. The study of living cells and tissues in culture (in vitro). The concept of an artifact.

Topic 2. The general organization of the cell. Plasmolemma. Intercellular contacts. The purpose and objectives of cytology, its significance for medicine. The main provisions of cell theory at the present stage of development of science. General plan of eukaryotic cell structure. Relationship between the shape and size of cells and their functional specialization in animals and humans.

The concept of the cell as an elementary living system. Eukaryotic cell as the basis of structure, function, reproduction, development, adaptation and regeneration of multicellular organisms. Cell derivatives as tissue components of multicellular organisms.

The structure of the cell membrane and its functions. Biological cell membranes, their structure, chemical composition and functions. Membrane proteins and glycocalyx. Their importance for the cell's life. The structure and functions of the cytoskeleton (submembrane complex). The principle of the structure of non-cellular structures. Characteristic of complementary and opposite functions of the plasmolemma. Mechanisms for the entry of molecules into the cell. Mechanisms for removing substances from the cell. Types of secretion. Cell junctions. The characteristic of synapse. Characteristic of gap and tight junctions. Characterization of desmosomes and semi-desmosomes.

Topic 3. Cytoplasm. Cell metabolism. Synthetic cell apparatus. The main components of the cytoplasm are hyaloplasm, organelles, inclusions. Hyaloplasm - definition, cytosol and cytomatrix, physicochemical properties, chemical composition, significance for cellular metabolism. Organelles - definition, classification. General and special purpose organelles.

Membrane organelles (granular and non-granular endoplasmic reticulum, Golgi complex, lysosomes, peroxisomes, mitochondria).

Topic 4. Nonmembrane organelles (ribosomes, centrioles, microtubules, microfilaments and intermediate filaments). Synthetic processes in the cell. Interaction of structural components of the cell in the synthesis of proteins and non-protein substances.

Topic 5. Inclusion - definition, classification, meaning.

Topic 6. Cell nucleus. The importance of the nucleus in the life of the eukaryotic cell, storage and transmission of genetic information. Shape, size, number of nuclei and nuclear-cytoplasmic ratio in different cell types. General structural characteristics of the nucleus. Nuclear shell. Its structure and functions. The structure of the nuclear membrane. The connection of the nucleus and cytoplasm. Nuclear pores. The functions of the nuclear membrane. Chromatin. Structure and chemical composition. Euchromatin and heterochromatin. Sex chromatin. Chromatin as a form of chromosome existence in the interphase nucleus. Composition of chromosomes: DNA, RNA, histone and non-histone proteins. Structure and function of chromosomes during cell division. Karyotype, ploidy. Nucleolus as a derivative of chromosomes. Nuclear organizers. The structure of the nucleolus and its role in the formation of ribosomes. Karyoplasm, physicochemical properties, chemical composition, importance in the life of the nucleus. Nuclear-cytoplasmic ratio as an indicator of the functional state of the cell.

Topic 7. Reproduction of cells. Cell cycle. Mitosis. The cell cycle and its periods. Types of cells derived from the cell cycle. Cell reproduction: mitosis, meiosis, endomitosis and amitosis. Interphase, characteristic, value. Mitosis. General characteristics. Restructuring of the structural components of the cell during various phases of mitosis: prophase, metaphase, anaphase, telophase. Intracellular regeneration. General morphofunctional characteristics, biological significance. Characterization of meiosis.

Topic 8. Aging and death of cell. Apoptosis and its biological and medical significance. Aging and cell death. Necrosis. Adaptation of cells, its importance for the preservation of cell life in altered conditions of existence.

Topic 9. Cell anomalies. Atypical mitoses. Amitosis is a direct division. Endomitosis. Polyploidy. Cell reactions to damaging effects. Reversible and irreversible cell changes. Their morphological manifestations.

Topic 10. Fundamentals of embryology. Progenesis. Fertilization. Implantation. Formation of extra-embryonic organs. Subject and tasks of human embryology. Medical embryology. The ratio of onto- and phylogeny. Stages of human development. Characteristic of the postnatal period of ontogenesis. Definition and stages of embryogenesis. Germ cells. Structure and functions of male and female germ cells, the main stages of their development. Meiosis as a mechanism of germ cell formation. Its serving. Characterization of fertilization and factors that contribute to this process. Characterization of the process of capacitation. Characterization of the acrosomal reaction. Penetration of sperm, the formation of the male pronucleus. Cortical reaction of the oocyte, completion of meiosis, formation of the female pronucleus. The concept of in vitro fertilization. Its medical and social significance. Multiple pregnancy. Zygote as a unicellular organism.

Topic 11. Early stages of development of embryo. Gastrulation. Definition and its content. The main methods of gastrulation in vertebrates. Characterization of the gastrulation process. The formation of ecto- and endoderm. The formation of the third germinal layer - mesoderm. Factors affecting the mechanisms of gastrulation. Formation of the allantochorion, its significance. Presomite and somite periods of embryo development. Derivatives of somites. Characterization of the neurulation process. Derivatives of the prechordal plate, ectoderm and endoderm. Cellular mechanisms of organogenesis. Morphogenetic transformations in the germs. Induction mechanisms, interstitial interactions.

Topic 12. Provisional organs. Placenta. Umbilical cord. The general plan of the structure of the placenta. The construction of the maternal part of the placenta. The structure of the fetal part of the placenta. Cellular and tissue elements of the fetal part of the placenta.

Characterization of the placentation process. Morphofunctional unit of the placenta. The structure of the hemochorial (placental) barrier. Function of the placenta. The structure and functions of the umbilical cord. The value of the amniotic membrane for the embryo. The structure of the amnion. The structure and functions of the yolk sac. The structure and functions of allantois.

Topic 13. Control of the information block №1. Questions on topics 1-12, test tasks, electronic microphotographs, histological specimens

INFORMATION BLOCK 2 GENERAL HISTOLOGY

Topic 14. General principles of tissue organization. Epithelial tissue. Covering epithelium. The concept of tissue. Contribution of O.O. Zavarzin, M. Khlopin and other scientists to the development of the doctrine of tissues. Classification of tissue types. The definition of the concept of cell-differon, stem cells, symplast and syncytium. Intercellular substance and its components. The concept of determination and differentiation of tissues. Physiological and reparative regeneration of various types of tissues. General characteristics of epithelial tissue (topography, basic morphofunctional features, function and sources of development). Classification of covering epithelium: by origin, structure and functions (phylogenetic and morphofunctional classification). Microscopic and ultramicroscopic structure of epithelial cells: general and special organelles, cell polarity, cell junctions. The structure and function of the basement membrane. The structure of simple epithelium (squamous, cuboidal, columnar, pseudostratified). Their function and localization. The structure of stratified epithelium (squamous keratinized, squamous non-keratinized and transitional). Physiological and reparative regeneration of epithelial tissues. Innervation, vascularization and age-related changes of the covering epithelium

Topic 15. Glandular epithelium. The structure of the glandular epithelium. Microscopic and ultramicroscopic structure of glandular secretory cells. Morphology of the secretory cycle and its phase. Types of glandular secretion (merocrine, apocrine, holocrine). Morphofunctional characteristics of exocrine glands. The principles of the structure and classification of exocrine glands. Vascularization, innervation and age-related changes in exocrine glands. The principles of the structure of the endocrine glands. Morphological signs of the endocrine glands. The main differences in the structure of the endocrine and exocrine glands. Types of gland regeneration. Features of the structure of the cytolemma of glandulocytes. Characterization of unicellular and multicellular glands. Mechanisms for regulating secretion in the glandular epithelium.

Topic 16. Blood. Erythrocytes. Hemogram. General characteristics of blood and its components as one of the types of tissues of the internal environment. The concept of the blood system and its components. Blood plasma, its composition and function. Formed blood elements, their classification. Red blood cells, structure, size and function. Reticulocytes. Structure, function. Changes in red blood cells during aging. The concept of anisocytosis, poikilocytosis. Definition of the concept of a hemogram and its significance for the clinic. The relative number and size of cells in a blood smear. The quantitative composition of red blood cells. The concept of erythrocytosis, erythropenia. Age-related changes in the number of red blood cells, reticulocytes. Erythrocyte sedimentation rate (ESR). ESR indicators in women and men, in healthy people and with different diseases.

Topic 17. Leukocytes. Leukocytic formula. Leukocytes. General characteristics, classification. Neutrophils. Morphofunctional characteristic. Eosinophils. Morphofunctional characteristic. Basophilic granulocytes. Morphofunctional characteristic. Lymphocytes. Morphofunctional characteristic T-lymphocytes, structure and function. B-lymphocytes, structure and function. The participation of lymphocytes in the body's immune responses. Monocytes. Morphofunctional characteristic. Lymph, its composition and function. The quantitative composition of granulocytes. The concept of neutropenia and neutrophilia. The concept of basophilia and basopenia. The concept of eosinophilia and eosinopenia. The quantitative composition of agranulocytes. Leukocyte formula and its significance for the clinic.

Leukocyte formulas at different stages of ontogenesis. Age-related changes in the number of leukocytes.

Topic 18. Platelets Hemopoiesis. Thrombocytes (blood platelets), structure and function. Number, size, shape of platelets. The role of platelets in hemostasis, inflammation, vascular wall repair. The concept of stages and mechanisms of thrombus formation. The definition of hematopoiesis and its types. Sources of blood development. Embryonic hemocytopoiesis, its features. Features of hematopoiesis in yolk sac and liver. Extravascular and intravascular type of hematopoiesis. Types of blood-forming tissues (myeloid and lymphoid), microenvironment. The theory of hematopoiesis. The modern scheme of hematopoiesis. Stem and semi-stem cells, their morphological characteristics. Postembryonic hemocytopoiesis, its features. Erythrocytopoiesis. Granulocytopoiesis. Thrombocytopoiesis. Monocytopoiesis. Lymph and immunocytopoiesis. Regulation of hemocytopoiesis.

Topic 19. Loose connective tissue. Dense connective tissue. Classification of connective tissue. Localization of loose fibrous connective tissue in the human body and its functions. General characteristics of loose fibrous connective tissue, its cellular composition. Types, structure and functions of fibroblasts. The structure and function of macrophages. The concept of macrophage system. Interaction of blood cells and connective tissue in inflammation. The concept of phagocytosis, the role of the macrophage system in this process. The structure and functions of plasma cells. The structure and functions of mast cells. The structure and function of collagen fibers. The structure and functions of elastic fibers. The structure and function of the reticular fibers. The chemical composition and function of the extracellular substance. The structure and functions of dense connective tissue. 2. The structure of the tendon and the reticular layer of dermis, as an example of the location of the regular and irregular dense connective tissue.

Topic 20. Connective tissue with special properties. Characterization of connective tissue with special properties. Characterization of adipose tissue. The structure of white adipose tissue. The structure of brown adipose tissue. The structure of the reticular tissue. The structure of pigment tissue. The structure of the mucous tissue. 9. The structure of adipocytes. The mechanism of recirculation of fat in the human body. The structure and function of pigment cells. The structure and functions of adventitious cells.

Topic 21. Skeletal connective tissue: cartilaginous tissue. The functional characteristic of cartilage tissue. Sources of development of cartilage. The general plan of the structure of cartilage tissue. Classification of cartilage. The structure of cartilage cells. The differences of cartilage cells. The structure of the intercellular substance of cartilage. The structural features of the cartilage tissue, which provide its basic functional characteristics. The structure and function of the perichondrium. Localization and structure of hyaline cartilage. Localization and structure of elastic cartilage. Localization and structure of fibrocartilage. Histogenesis of cartilage. Types of cartilage growth. Cartilage tissue regeneration and age-related changes.

Topic 22. Skeletal connective tissue: bone tissue. General characteristics of bone tissue. The structure and function of osteoblasts. The structure and function of osteocytes. The structure and function of osteoclasts. The structure and chemical composition of the intercellular substance. The structure of the bone as an organ. The structure and function of the periosteum. The structure of woven bone tissue. Morphofunctional characteristic of lamellar bone tissue. Compact and spongy bone. Features of the structure. The structure of the diaphysis of the tubular bone. Tubular bone regeneration. Age-related changes in bone tissue. Factors affecting the structure of bones and their formation. Development of bones. Sources of bone tissue development. Types of bone tissue development. Cells that are involved in the formation and destruction of bone tissue. Intramembranous ossification. Stages of intramembranous ossification. Formation of ossification center. The formation of osteoid. The formation of primary cancellous bone. Calcification of intercellular substance. The formation of secondary cancellous bone. Endochondral ossification. The formation of the cartilage model. Perichondral

ossification. Endochondral ossification. The formation of the epiphyseal (secondary) center of ossification. The formation of tubular bones.

Topic 23. Muscle tissue: smooth, striated skeletal and cardiac muscle tissue. General morphological characteristics Classification of muscle tissue. Sources of development of muscle tissue. Skeletal muscle tissue. Localization and function. The histological structure of skeletal muscle tissue. The contractile apparatus of skeletal muscle tissue. The structural and functional unit of myofibrils is the sarcomere. Sarcoplasmic reticulum and T-system. Smooth muscle tissue, localization, structure and functional features. The features of contraction of smooth muscle tissue. The structure and function of cardiac muscle tissue. Typical and atypical cardiomyocytes. Differences of cardiac muscle tissue from skeletal. Molecular mechanisms of muscle fiber contraction. The structure of the muscle as an organ. The structure of red and white muscle fibers. Muscle tissue regeneration and age-related changes.

Topic 24. Nervous tissue. Neurons and neuroglia. General morphological and functional characteristics of the nervous tissue. Sources of development and histogenesis of nerve tissue. Morphological and functional classification of neurons. Microscopic and submicroscopic structure of the neurocyte. General and special organelles of neurons. The functional value of the processes of nerve cells. Neuroglia. Characterization and classification. The structure, value and localization of ependymocytes. The structure, value and localization of astrocytes. The structure, value and localization of oligodendrocytes. Characterization of microglia, function and localization. Microglia of the central and peripheral nervous system. Regeneration of nerve cells.

Topic 25. Nervous tissue. Nerve fibers and nerve endings. Regeneration of nerve fibers. General characteristics of nerve fibers. Non-myelinated nerve fibers. Microscopic structure. The concept of mesaxon. Myelinated fibers. Microscopic structure. The structure of the myelin sheath. The mechanism of myelin formation. Conducting nerve impulses in nerve fibers. The construction of a neurolemma. Differences in the structure of nerve fibers. Regeneration of nerve fibers. Degeneration of nerve fibers. General morphological and functional characteristics of nerve endings. Receptor nerve endings, their classification. The structure of free nerve endings and their localization. Effector nerve endings, their classification. Motor nerve endings, their localization and function. Secretory nerve endings, their localization and function. Synapses, their classification. The construction of synapses and functions. Mechanisms of transmission of a nerve impulse. The concept of a reflex arc. The structure of simple and complex reflex arcs.

Topic 26. Control of the information block №2. Questions on topics 14-25, test tasks, electronic microphotographs, histological specimens.

INFORMATION BLOCK 3 SPECIAL HISTOLOGY AND EMBRYOLOGY

Topic 27. Nervous system. Spinal cord. General characteristics of the nervous system. Embryogenesis of the nervous system. Malformations of the nervous system. The role of the nervous system in the life of the body. Physiological and anatomical classification of the nervous system. Development of the spinal cord and dorsal root ganglion. The concept of a segment of the spinal cord. The spinal cord. Gray and white matter. Characterization of the cells of the gray matter of the spinal cord. The nuclei of the gray matter of the spinal cord. Characterization of neuroglia. The concept of own apparatus of the spinal cord.

Topic 28. Nervous system. Brain. The development of the brain. General characteristics of the brain. The general plan of the structure of the brain and its function. Cytoarchitectonics of the cerebral cortex. Layers of the motor zone of the cortex. The concept of the module. Characteristics of the brain stem. The concept of associative, projective and commissural fibers. The general plan of the structure and function of the cerebellum. Neural composition and layers of the cerebellar cortex. Morphofunctional characteristics of cerebellar neurons. Neuroglia of the cerebellum. Afferent and efferent connections of the cerebellum. Brain membranes. Features of blood supply. Age-related changes organs of the central nervous system.

Topic 29. Peripheral nervous system Autonomic nervous system. The dorsal root ganglion, localization and general plan of the structure. The main tissue elements of the dorsal root ganglion. The anterior and posterior roots of the spinal cord. The structure of the peripheral nerve. The blood brain barrier. Characteristic of the autonomic nervous system. The functional differences of the somatic and autonomic parts of nervous system. The central parts of the sympathetic and parasympathetic nervous system. The peripheral part of the autonomic nervous system. Autonomic ganglions, their structure and functions. Morphofunctional characteristics of Dogel cells. Differences in the structure of the autonomic and dorsal root ganglions. The concept of reflex arcs. Characterization of different types of reflex arcs. The differences of the somatic reflex arc and autonomic arcs. The structure of the efferent part of the autonomic reflex arc. Preganglionic fibers, their localization, characteristic. Postganglionic fibers, their localization, characteristic.

Topic 30. Sensory system. Organ of vision. The concept of sensory organs and analyzers. Classification of the sense organs. General characteristics of the organ of vision. The tunics of the eyeball. Functional apparatus of the eye. The structure of the fibrous tunic of the eyeball. The structure of the vascular tunic. The structure and functions of the lens. The structure and functions of the vitreous body. The retina and its structural components. Photoreceptor cells. Associative cells. Ganglion cells. Retinal pigment epithelium, its functions. Adaptive retinal changes in lighting and in the dark. Neuroglia of the retina, its functions. The layers of the retina. Age-related changes in the visual organ.

Topic 31. Sensory systems Organ of hearing and balance. General characteristics of the auditory and vestibular organs. Development of the inner ear. Structural elements of the outer ear and their functional significance. Structural elements of the middle ear and their functional significance. The inner ear. Localization of receptor part of the auditory and vestibular organs. The general plan of the structure of cochlea and cochlea canals. The structure of the organ of Corti. Histophysiology of the auditory organ. The vestibular part of the membranous labyrinth. The structure of the macula of the saccule and the utricle and their functional significance. The structure and function of crista ampullaris. Age-related changes in the auditory organ.

Topic 32. Sensory systems. Organ of taste. Organ of smell. Classification of the sense organs. The development of the olfactory organ. Characterization of the nasal cavity. General plan of the structure of the organ of smell. The cytological characteristic of the olfactory cells. The cytological characteristic and function of the supporting and basal cells of the organ of smell. Histophysiology of the organ of smell. General characteristics of the taste sensory system. The development of the organ of taste. The structure of the taste bulb. Cytological characteristic of the gustatory cells. The structure and function of the supporting and basal cells of the organ of taste. Histophysiology of the organ of taste.

Topic 33. Endocrine system. Organs of the central endocrine system. The endocrine system. Morphofunctional characteristic. Classification of the organs of the endocrine system. Structure of the endocrine glands. The concept of hormones, their types, place of action (target cells). The hypothalamus. The structure and functions of the anterior part. The structure and function of the middle part. The ultrastructure of the neurosecretory cells of the hypothalamus. The development of the hypothalamus. Blood supply connection of the hypothalamus and adenohypophysis. Pineal gland, sources of development. The structure of the pineal gland. Characterization of pineal gland cells Hormones of the pineal gland, their effect. Sources and main stages of embryonic development of the pituitary gland. General characteristics of the pituitary gland. The structure of the pituitary gland. The cellular composition of the adenohypophysis. Characterization of chromophilic cells of the adenohypophysis. Hormones of the adenohypophysis, their effect. Characterization of chromophobic cells of the adenohypophysis. General characteristics of the pars intermedia of pituitary gland. The structure of the pars tuberalis of the pituitary gland. The structure of the neurohypophysis. The system of the hypothalamus-adenohypophysis, its role. The system of the hypothalamus-neurohypophysis. Disorders of pituitary gland. General characteristics of the diffuse endocrine system.

Morphological and functional characteristics of endocrinocytes APUD - system. Diffuse hormone-producing cells of non-neural origin. The relationship of the endocrine system with other body systems.

Topic 34. Endocrine system. Organs of the peripheral endocrine system. Sources of thyroid development. General morphological and functional characteristics of the thyroid gland. The structure of the thyroid gland, tissue and cell composition, structural and functional unit. Characterization of thyrocytes with normo-, hypo- and hyperfunction. Phase of production in secretory cycle of thyrocytes. The phase of the excretion of hormones, their effect on the body. Parafollicular cells, their role. Disorders of thyroid gland. Sources of development of the parathyroid glands, age-related changes. Parathyroid glands, general characteristic. Tissue and cell composition of the parathyroid glands. Hormone of the parathyroid glands and its participation in the regulation of calcium homeostasis. The effect of hypofunction of the parathyroid glands on the body. Sources of adrenal gland development, age-related changes. General morphofunctional characteristics of the adrenal gland. The structure of the adrenal cortex. Characterization of the zona glomerulosa of the cortex. The zona fasciculata of the adrenal cortex, hormones, their effect on the body. The zona reticularis of the adrenal gland cortex, its hormones. Ultramicroscopic structure of adrenal cortical cells. Sources of physiological regeneration of the adrenal cortex. Regulation of the secretory function of cells of the adrenal gland cortex. The structure of the adrenal medulla, the cellular composition.

Topic 35. Cardiovascular system. Blood vessels. Microcirculatory bed. General morphofunctional characteristics of the cardiovascular system. Classification of blood vessels. General regularities of the structural organization of the vessels. Morphofunctional characteristics of arteries and their classification. The structure of arteries of elastic type. The structure of muscle arteries. The structure of mixed arteries. Morphofunctional characteristics of veins and their classification. The structure of the nonmuscular (fibrous) type veins. The structure of the muscular type veins. Development of blood vessels. Morphofunctional characteristics of blood vessels of the microvasculature. The general principle of the organization of the circulatory microvasculature. Features of the structural organization of the arterial link of the blood microvasculature. Organ specificity of the structure of capillaries. Classification of capillaries. The structure of the capillary wall. Characterization of the endothelium. Function of the endothelium. The structure and functions of the basement membrane and pericytes. Characteristics of continuous capillaries. Characterization of fenestrated capillaries. Characteristic of the sinusoidal capillaries. Features of the structural organization of the venous link of the microvasculature. Arterio-venular anastomoses, general characteristic. Typical and atypical arteriovenular anastomoses.

Topic 36. Cardiovascular system. Heart. Lymphatic vessels. General characteristics and structure of the heart. Heart development. The structure and function of the endocardium. The structure and functions of the myocardium. The structure and functions of the epicardium. The structure and functions of the pericardium. The structure and function of contractile cardiomyocytes. The ultrastructural structure of contractile cardiomyocytes. Types of junctions of contractile cardiomyocytes. Characteristic of the conduction system of the heart. The structure and function of pacemaker cells. The structure and function of transitional cells. The structure and function of Purkinje fibers. Ultrastructural characteristic of atrial cardiomyocytes. General characteristics of the lymphatic vessels. Lymphatic capillaries and their functions. Structure of lymphatic vessels. The structure of the main lymphatic trunks.

Topic 37. Central and peripheral organs of hematopoiesis and immune defense. General characteristics of organs of hematopoiesis and immune defense. Classification of organs of hematopoiesis and immune defense. The general plan of the structure of the organs of hematopoiesis and immune defense. Characterization of red bone marrow. The structure of red bone marrow. The interaction of hematopoietic, stromal and vascular components of the red bone marrow. The development of red bone marrow. Age-related changes in red bone marrow. Blood supply of the red bone marrow. Humoral regulation of hemocytogenesis in the red bone

marrow. Regeneration of the red bone marrow. Red bone marrow is the central organ of immunocytopoiesis. Yellow bone marrow. General characteristics of the thymus as a central organ of lymphocytopoiesis and immunogenesis. General plan of the structure and localization of the thymus. Morphology of the thymus cortex. Morphology of the medulla of the thymus. The blood-thymus barrier. Blood supply of the thymus lobules. Development and age-related changes in the thymus. Accidental involution of the thymus and its regeneration. General characteristics and functional significance of the lymph nodes. The cortex of the lymph nodes. Medulla and paracortical zone. The structure and significance of the sinuses. The participation of lymph nodes in the proliferation, differentiation and maturation of T - and B - lymphocytes. The development of lymph nodes. General plan of the structure and functional significance of the spleen. The structure, cellular composition and significance of the white pulp of the spleen. The structure, cellular composition and significance of red pulp. Blood supply in the spleen. The development of the spleen. Age-related changes and regenerative capabilities. Hemolymphatic nodes, structure and functional value. Lymphoid follicles (nodules) in the wall of the respiratory and digestive tract. General characteristics of tonsils as a peripheral organ of lymphocytopoiesis and immunogenesis. The importance of tonsils for the body. Development of tonsils. The concept of the immune system. Definition of term "antigens". Definition of the term "antibody". Definition of the term "immunity". Characterization and function of different types of Ig. Characterization of immunocompetent cells. Antigen-independent differentiation of lymphocytes. Antigen-dependent proliferation and differentiation of lymphocytes. Cellular immunity. Humoral immunity. Intercellular interactions in providing immune defense. Biological effects of interleukins. Mechanisms for the integration of elements of the immune system. Involvement of mast cells and eosinophils in immune responses

Topic 38. Respiratory system. General morphofunctional characteristics. The nasal cavity. Structure and function. Characterization of the olfactory region of the nasal cavity. Morphological and functional characteristics of the larynx. Characterization of the membranes of the larynx. Morphological and functional characteristics of the trachea. The structure and function of the bronchi of different caliber. Characterization of terminal bronchioles. Morphological and functional characteristics of the lungs. The structure and function of the acinus. The structure of the alveoli of the lungs. Surfactant alveolar complex. The development of the respiratory system. The air-blood barrier. Characterization of the pleura. Characterization of non-respiratory lung function.

Topic 39. Skin and its derivatives. Skin functions and its significance. Sources of development and the general plan of the structure of the skin. The tissue composition of the skin and its role in the life of the body. Microscopic and submicroscopic structure of the cells of the stratum basale of the epidermis. Microscopic and submicroscopic structure of the cells of the stratum spinosum of the epidermis. The structure of the stratum granulosum of the epidermis. The structure of the stratum lcidum of the epidermis. The structure of the stratum corneum of the epidermis. Morphofunctional characteristic of the papillary dermis. Morphofunctional characteristic of the reticular dermis. Sources of development, structure and function of the hypodermis. Features of the structure of the skin in different parts of the body. Derivatives skin. Histophysiology of sweat and sebaceous glands. The structure and physiological significance of hair. The structure, function and growth of nails. Age and gender features of the skin.

Topic 40. General description of organs of the digestive system. Organs of oral cavity. General organization of the digestive tube. The structure of the mucous membrane of the digestive tube. The structure of the muscular and external membranes of the digestive tube. Sources of digestive tube development. General characteristics of the oral cavity. The structure of the oral mucosa. Morphofunctional characteristics of the mucous membrane of different zones of the tongue. The structure and function of different types of tongue papillae. The structure of the tongue body. Structurally functional characteristic of the hard palate. Structurally functional characteristic of the soft palate. Morphofunctional characteristics of the gums. Morphofunctional characteristics of the lips. The structure of the cheek. Features of the structure of the intermediate

zone of the cheek. Structure of baby and permanent teeth. The general plan of the tooth structure. Types of teeth Morphofunctional characteristic of enamel. The structure of enamel. Enamel plates, bunches, spindles. Cuticle and pellicula of the tooth. The structure of dentin. Types of dentin. Primary, secondary and tertiary dentin. The structure and function of odontoblasts. The structure and significance of the pulp. Morphological characteristics of cement. Cellular and acellular cement. Comparative characteristics of cement and bone tissue. Age-related changes in tooth enamel. Age-related changes in tooth pulp. Age-related changes in tooth dentin. The reaction of tooth tissues to damage. Development of baby and permanent teeth. The formation of the dental plate and buds. The formation of dental germs. Differentiation of the dental germs. Morpho-functional characteristics of ameloblasts. Histogenesis of tooth tissues. The formation of a tooth crown. The formation of the tooth root. The formation of tooth cement (cementogenesis). The development of periodontium. The clinical significance of violations of the early stages of tooth development. The development of tooth pulp.

Topic 41. Digestive system: pharynx, esophagus, stomach. Pharynx (throat): parts, features of the structure of the pharyngeal wall: mucous membrane, submucosal layer, muscular membrane. Esophagus. Stomach. The development of the esophagus. Characterization of the mucous membrane of the esophagus. Features of the submucosa of the esophagus. The muscular membrane of the esophagus. The outer membrane of the esophagus. General morphological and functional characteristics of the stomach. Morphological characteristics of the wall of the stomach. Relief of the gastric mucosa. Characterization of the gastric glands. The main exocrinocytes of the gastric glands. Parietal exocrinocytes of the gastric glands. Cervical mucocytes of the gastric glands. Endocrinocytes of the gastric glands. Cardial and pyloric glands of the stomach.

Topic 42. Digestive system: small and large intestine. Sources of development of the small and large intestine. General characteristics and functions of the small intestine. The structure of the mucous membrane of the small intestine. The structure of the submucosa of the small intestine. The structure of the muscle and serous membranes of the small intestine. Features of the structure of different departments of the small intestine. Histophysiology of the crypt-villus system. Morphofunctional characteristics of columnar epithelial cells in the small intestine. Morphofunctional characteristic of goblet cells in the small intestine. Morphofunctional characteristics of endocrinocytes in the small intestine. Paneth cells, structure and significance. General characteristics and functions of the large intestine. The structure of the wall of the large intestine. The appendix, structure and function. The structure of the rectum.

Topic 43. Glands of the digestive tract: salivary glands, pancreas, liver. General characteristics and types of the salivary glands. The general structure of the large salivary glands. Functions of saliva. The composition and functional significance of saliva. The main signs of muco- and serocytes. The structure of the submandibular gland. Characterization of the end piece of the submandibular salivary gland. The system of excretory ducts of the submandibular salivary gland. The structure of the parotid salivary gland. End piece and system of excretory ducts of the parotid salivary gland. The structure of the sublingual salivary gland. End piece and system of excretory ducts of the sublingual salivary gland. The functional characteristics of the small salivary glands. Development of the salivary glands. Age-related changes in the salivary glands. General characteristics and functions of the liver. The structure of the classic lobule of the liver. Features of blood supply to the liver. Histophysiology of the liver cord. The microscopic and ultramicroscopic structure of hepatocytes. Morphological characteristics of the gallbladder and biliary tract. Liver development. General plan of the structure and function of the pancreas. The structure and histophysiology of the exocrine part of the pancreas. The structure of exocrine pancreatic cells, centroacinar cells. Morphology of the secretory process in the pancreas. Excretory ducts of the pancreas. The submicroscopic structure of the endocrine cells of the pancreatic islets. Characteristics of the islets of Langerhans, their localization and significance. Sources of pancreatic development.

Topic 44. Urinary system. General plan of organization of the urinary system. Embryogenesis of the kidney. Embryogenesis of the mesonephros. Embryogenesis of the metanephros. The mechanism of primary urine formation. The mechanism of secondary urine formation. General characteristics of nephrons. General characteristics of collecting ducts. Structural components of the nephron. Features of blood supply of the kidneys. Features of blood supply of the juxtamedullary nephrons. Characterization of the mucous membrane of the urinary tract. The structure of the muscular and external membranes of the urinary organs. The structure of the urethra. Filtration barrier.

Topic 45. Male reproductive system. The general plan of the structure of the male reproductive system. Embryogenesis of the male reproductive system. General characteristics of the structure of the testis. The structure of the lobule of the testicle, the walls of the convoluted tubule of the testicle. Morphological characteristics of the sustentocytes. Spermatogenesis, significance. Endocrinocytes of testis. The structure and significance of the hematotesticular barrier. The structure and function of the epididymis. The structure and functions of the ductus deferens and ejaculator ducts. Structural features of the male ureter. Morphofunctional characteristic of seminal vesicles. Bulbourethral glands. Embryogenesis and structure of the prostate gland, its age-related changes. Prostaglandins, their significance.

Topic 46. Female reproductive system. The general plan of the female reproductive system. Features of the embryogenesis of the female reproductive system. The general plan of the structure of the ovary. The structure of immature follicles. The structure of a mature follicle. Characterization of oogenesis. Multiplication phase. Characterization of the growth phase. Features of human oocyte meiosis. Characterization of the maturation stage in oogenesis. Characterization of the ovulation mechanism. Stages of development of the corpus luteum. The significance of the heyday of the corpus luteum. The significance of atretic follicles for the function of the female reproductive system. The value of atretic follicles for the functioning of the female reproductive system. General structural features of the uterus. Characterization of the endometrium. Characterization of the myometrium. The structure of the cervix. Cyclic changes in the cervical mucosa. General characteristics of the fallopian tubes. Histophysiology of the fallopian tubes. The structure of the vagina. The structure of the external genitalia. Labia minora. Clitoris. Histophysiological features of the mammary glands. Cyclical changes in the mammary gland.

Topic 47. Control of the information block №3 Questions on topics 27-46, test tasks, electronic microphotographs, histological specimens.

Structure of the academic discipline

Tema	Lectures	Laboratory classes	Student independent work	Total
Information block 1. Cytology and Embryology				
Topic 1. Optical devices. Rules for working with a microscope. Special methods of research in cytology, embryology, histology.	1	2	6	9
Topic 2. The general organization of the cell. Plasmolemma. Intercellular contacts	0,5	2	1	3,5
Topic 3. Cytoplasm. Cell metabolism. Synthetic cell apparatus	0,5	2	1	3,5
Topic 4. Nonmembrane organelles	0,25	2	1	3,5
Topic 5. Inclusion - definition, classification, meaning	0,25	2	1	3,0
Topic 6. Cell nucleus	0,5	2	1	3,5
Topic 7. Reproduction of cells. Cell cycle. Mitosis	0,5	2	1	3,5
Topic 8. Aging and death of cell	0,25	2	1	3,5
Topic 9. Cell anomalies	0,25	2	1	3,0
Topic 10. Fundamentals of embryology. Progenesis. Fertilization. Implantation. Formation of extra-embryonic organs	1	2	3	6,0
Topic 11. Early stages of development of embryo	0,5	2	3	5,5
Topic 12. Provisional organs. Placenta. Umbilical cord	0,5	2	2	4,5
Topic 13. Control of the information block №1		2		2,0
Total hours:	6	26	22	54
Information block 2. General Histology				
Topic 14. General principles of tissue organization. Epithelial tissue. Covering epithelium.	1	2	4	8
Topic 15. Glandular epithelium.	1	2	2	4
Topic 16. Blood. Erythrocytes. Hemogram.	1	2	4	8
Topic 17. Leukocytes. Leukocytic formula.	0,5	2	4	6
Topic 18. Platelets. Hemopoiesis.	0,5	2	4	6
Topic 19. Loose connective tissue. Dense connective tissue.	0,5	2	4	6
Topic 20. Connective tissue with special properties.	0,5	2	2	6
Topic 21. Skeletal connective tissue: cartilaginous tissue.	0,5	2	4	6
Topic 22. Skeletal connective tissue: bone tissue.	0,5	2	4	6
Topic 23. Muscle tissue: smooth, striated skeletal and cardiac muscle tissue.	2	2	2	6
Topic 24. Nervous tissue. Neurons end neuroglia.	1	2	4	8
Topic 25. Nervous tissue. Nerve fibers and nerve endings. Regeneration of nerve fibers.	1	2	4	6
Topic 26. Control of the information block №2		2		2
Total hours:	10	26	42	78
Information block 3. Special Histology and Embryology				
Topic 27. Nervous system. Spinal cord.	0,5	2	4	8
Topic 28. Nervous system. Brain.	1	2	3	5
Topic 29. Peripheral nervous system Autonomic nervous system	0,5	2	2	4
Topic 30. Sensory system. Organ of vision	1	2	4	8

Topic 31. Sensory systems Organ of hearing and balance	0,5	2	2	4
Topic 32. Sensory systems. Organ of taste. Organ of smell	0,5	2	2	4
Total hours (2 semestr):	20	64	81	165
Topic 33. Endocrine system. Organs of the central endocrine system	1	2	3	6
Topic 34. Endocrine system. Organs of the peripheral endocrine system	1	2	3	6
Topic 35. Cardiovascular system. Blood vessels. Microcirculatory bed	1	2	3	6
Topic 36. Cardiovascular system. Heart. Lymphatic vessels	1	2	2	5
Topic 37. Central and peripheral organs of hematopoiesis and immune defense	2	2	4	8
Topic 38. Respiratory system	1	2	4	7
Topic 39. Skin and its derivatives	1	2	4	7
Topic 40. General description of organs of the digestive system. Organs of oral cavity	1	2	4	7
Topic 41. Digestive system: pharynx, esophagus, stomach	0.5	2	2	4,5
Topic 42. Digestive system: small and large intestine	0.5	2	2	4,5
Topic 43. Glands of the digestive tract: salivary glands, pancreas, liver	2	2	2	6
Topic 44. Urinary system	2	2	6	10
Topic 45. Male reproductive system	1	2	3	6
Topic 46. Female reproductive system	1	2	3	6
Topic 47. Control of the information block №3		1		1
Total hours:	16	29	45	90
Total:	36	93	126	255

4. The content of the discipline

4.1. Lecture plan

№ 3.п.	TOPIC / PLAN	Number of hours
INFORMATION BLOCK 1 CYTOLOGY AND EMBRYOLOGY		
1	Topic 1. Optical devices. Rules for working with a microscope. Special methods of research in cytology, embryology, histology. 1. Subject and tasks of histology, cytology and embryology. 2. The history of the development of Histology, Cytology, Embryology. 3. Methods of histological, cytological and embryological studies	1
2	Topic 2. The general organization of the cell. Plasmolemma. Intercellular contacts. 1. The main provisions of cell theory. 2. General plan of eukaryotic cell structure 3. Structure and functions of plasmolemma 4. Cell junctions	0,5
3	Topic 3. Cytoplasm. Cell metabolism. Synthetic cell apparatus 1. Chemical composition and functions of the cytoplasm 2. Organelles. Principles of classification of organelles 3. Characteristics of membrane organelles	0,5

4	Topic 4. Nonmembrane organelles 1. Characteristics of non-membrane organelles	0,25
5	Topic 5. Inclusion - definition, classification, meaning 1. Characteristics and functional significance of inclusions 2. Classification of inclusions	0,25
6	Topic 6. Cell nucleus 1. Morphology and functions of the nucleus 2. The nucleolus 3. Chromatin. Types of chromatin 4. Morphology of mitotic chromosomes 5. Karyotype	0,5
7	Topic 7. Reproduction of cells. Cell cycle. Mitosis. 1. The cell cycle. Cell reproduction 2. Cell division. Mitosis	0,5
8	Topic 8. Aging and death of cell. 1. Paronecrosis. Structural and functional changes of the cell during aging 2. Cell death: apoptosis, necrosis	0,25
9	Topic 9. Cell anomalies 1. Atypical mitoses 2. Reactions of cells to the damaging effect	0,25
10	Topic 10. Fundamentals of embryology. Progenesis. Fertilization. Implantation. Formation of extra-embryonic organs 1. Importance of embryology for medicine and biology. 2. General characteristics of gametogenesis. Differences in spermatogenesis and ovogenesis. 3. The structure of the ovum and sperm. 4. Fertilization.	1
11	Topic 11. Early stages of development of embryo 1. Gastrulation. Formation of ecto-and endoderm. 2. The formation of the mesoderm. 3. Presomite and somatic periods of embryo development. 4. Characteristics of the neuralulation process.	0,5
12	Topic 12. Provisional organs. Placenta. Umbilical cord 1. Characteristics of the placenta. Types of placenta. 2. The structure and function of the umbilical cord. 3. Early stages of human development. 4. Critical periods of human embryo development	0,5
INFORMATION BLOCK 2 GENERAL HISTOLOGY		
13	Topic 14. General principles of tissue organization. Epithelial tissue. Covering epithelium 1. The role of tissue. Tissue classification 2. The concept of differon, differentiation and stem cells. 3. General morpho-functional characteristics of epithelial tissues. 4. Classification of the covering epithelium. Localization in the body. 5. Features of physiological and reparative regeneration of epithelial tissues.	1
14	Topic 15. Glandular epithelium 1. General morpho functional characteristics of the glandular epithelium 2. Glands.Principles of classification. End sections and excretory ducts.	1

	3. Phases of the secretory cycle and their histological characteristics. 4. Types of secretion.	
15	Topic 16. Blood. Erythrocytes. Hemogram 1. General characteristics of blood 2. Blood Plasma. Composition of blood plasma 3. Blood elements. Red blood cells. Structure. Functions. Types of red blood cells. Quantitative composition. 4. Hemogram	1
16	Topic 17. Leukocytes. Leukocytic formula 1. Leukocytes. Classification of leukocytes and their characteristics. . Quantitative composition 2. Lymph, composition. Characteristic. Function. 3. Leukocyte formula.	0,5
17	Topic 18. Platelets Hemopoiesis 1. Platelets. Number, functions. 2. Age-related changes in blood 3. General characteristics of hematopoietic organs. 4. Embryonic hematopoiesis. 5. Postembryonic hematopoiesis. 6. Modern theory of hematopoiesis.	0,5
18	Topic 19. Loose connective tissue. Dense connective tissue 1. Development and morphofunctional characteristics of connective tissues. 2. General morphological and functional characteristics of fibrous connective tissues. 3. Classification of connective tissue. Localization in the body. 4. Loose connective tissue. Structure and function. 5. Dense connective tissue. Structure, functions, classification.	0,5
19	Topic 20. Connective tissue with special properties 1. Characteristics of adipose tissue 2. Reticular tissue 3. Pigmented tissue 4. Mucous tissue	0,5
20	Topic 21. Skeletal connective tissue: cartilaginous tissue 1. Development and morphofunctional characteristics of skeletal tissues 2. General morphofunctional characteristics of cartilage. 3. Classification of cartilage. Localization in the body. 4. Regeneration and growth of cartilage tissue. 5. Agerelated changes.	0,5
21	Topic 22. Skeletal connective tissue: bone tissue 1. General morpho-functional characteristics of bone tissue 2. Regeneration and growth of bone tissue. 3. Age changes	0,5
22	Topic 23. Muscle tissue: smooth, striated skeletal and cardiac muscle tissue 1. Morphofunctional characteristics of muscle tissue. 2. Histogenesis of muscle tissue. 3. Classification of muscle tissue. Localization in the body. 4. The structure of the sarcomere.	2

	5. Regeneration and growth of muscle tissue. Age-related changes.	
23	Topic 24. Nervous tissue. Neurons and neuroglia 1. Morphofunctional characteristic of nerve tissue. 2. Development of nerve tissue. 3. Characterization of neurons. Structure, classification. 4. Neuroglia. Structure and function. 5. Reflex arc.	1
24	Topic 25. Nervous tissue. Nerve fibers and nerve endings. Regeneration of nerve fibers 1. Nerve fibers and endings 2. Regeneration of nerve fibers	1
INFORMATION BLOCK 3 SPECIAL HISTOLOGY AND EMBRYOLOGY		
25	Topic 27. Nervous system. Spinal cord 1. General characteristics of the nervous system 2. Development of the organs of the central nervous system	0,5
26	Topic 28. Nervous system. Brain 1. General characteristics of the brain 2. The general plan of the structure of the brain and its function 3. Cytoarchitectonics of the cerebral cortex	1
27	Topic 29. Peripheral nervous system Autonomic nervous system 1. The dorsal root ganglion, localization and general plan of the structure The main tissue elements of the dorsal root ganglion 2. The structure of the peripheral nerve 3. The blood brain barrier. Characteristic of the autonomic nervous system. 4. The peripheral part of the autonomic nervous system. Autonomic ganglions, their structure and functions 5. Characterization of different types of reflex arcs. The differences of the somatic reflex arc and autonomic arcs	0,5
28	Topic 30. Sensory system. Organ of vision 1. The concept of sense organs 2. Development of the organ of vision 3. Morphofunctional characteristic of the organ of vision 4. Age-related changes and regeneration of the organ of vision	1
29	Topic 31. Sensory systems Organ of hearing and balance 1. Morphofunctional characteristic of the organ of hearing and balance	0,5
30	Topic 32. Sensory systems. Organ of taste. Organ of smell 1. Structure of the organ of smell 2. Age-related changes and regeneration of the organ of smell 3. Morphofunctional features of the taste organ	0,5
31	Topic 33. Endocrine system. Organs of the central endocrine system 1. General characteristics and classification of the organs of the endocrine system 2. Features of the action of hormones on target cells 3. Sources of development of the organs of the endocrine system 4. Morphofunctional characteristic of the central organs of the endocrine system	1
32	Topic 34. Endocrine system. Organs of the peripheral endocrine system 1. Structure of the peripheral organs of the endocrine system	1

33	<p>Topic 35. Cardiovascular system. Blood vessels. Microcirculatory bed</p> <p>1. General characteristics and classification of the organs of the cardiovascular system</p> <p>2. Classification of blood vessels. General plan of the structure of the vascular wall. Dependence of the structure of the vessel wall on the conditions of hemodynamics</p> <p>3. Characteristics of vessels of the microcirculatory bed</p>	1
34	<p>Topic 36. Cardiovascular system. Heart. Lymphatic vessels</p> <p>1. Heart. Myocardium. Features of the structure and function of muscle tissue. Sources of development, features of histogenesis</p> <p>2. Lymphatic vessels. Classification, structure of lymphatic vessels of different types. Peculiarities of the structure of lymphatic capillaries and postcapillaries, participation in microcirculation</p>	1
35	<p>Topic 37. Central and peripheral organs of hematopoiesis and immune defense</p> <p>1. General characteristics and classification of organs hematopoiesis and immune defense</p> <p>2. Sources of the development of organs hematopoiesis and immune defense</p> <p>3. Morphofunctional characteristic of the central organs of hematopoiesis</p> <p>4. Structure of peripheral organs of hematopoiesis and immune defense</p>	2
36	<p>Topic 38. Respiratory system</p> <p>1. General characteristics and functions of the respiratory system</p> <p>2. Embryogenesis of the respiratory system</p> <p>3. Structural and functional organization of the conductive portion of respiratory system</p> <p>4. Lungs. Structural units of the lungs</p> <p>5. Respiratory department. Structural elements of lung acinus</p> <p>6. Aerogematic barrier</p> <p>7. Blood supply and innervation of organ of the respiratory system</p>	1
37	<p>Topic 39. Skin and its derivatives</p> <p>1. General characteristics of the outer coverings of the body</p> <p>2. Skin. Structure and functions. Physiological regeneration of the epidermis</p> <p>3. Hair structure and function</p> <p>4. General plan of the nail structure. Nail functions</p> <p>5. Morpho-functional features of skin glands</p>	1
38	<p>Topic 40. General description of organs of the digestive system. Organs of oral cavity</p> <p>1. General characteristics, classification and functions of the digestive system</p> <p>2. Sources of development of the digestive system</p> <p>3. Morphofunctional characteristics of the organs of the anterior part of digestive system</p> <p>4. Structure of the digestive tube in different departments</p> <p>5. Oral organs and their characteristics</p>	1
39	<p>Topic 41. Digestive system: pharynx, esophagus, stomach</p> <p>1. Morphofunctional characteristics of the pharynx and esophagus</p> <p>2. Structure of the stomach</p>	0.5

40	Topic 42. Digestive system: small and large intestine 1. Morphofunctional characteristics of the small intestine 2. Morphofunctional characteristics of the large intestine	0.5
41	Topic 43. Glands of the digestive tract: salivary glands, pancreas, liver 1. Salivary glands: features of structure 2. Structure of the endocrine and exocrine parts of the pancreas 3. Structure and functions of the liver. Characterization of hepatocytes.	2
42	Topic 44. Urinary system 1. General characteristics and functions of the urinary system 2. Sources of development of the urinary system 3. Morphofunctional characteristics of the kidney 4. Structure of the nephron. Types of nephrons. The mechanism of urine formation 5. Structure of the urinary tract	2
43	Topic 45. Male reproductive system 1. General characteristics and functions of the organs of the male reproductive system 2. Sources of development of the organs of the male reproductive system 3. Morphofunctional characteristics of the testis. Endocrine function of testis 4. Structure of seminiferous tubules. Spermatogenesis 5. Structure of the ductus deferens. Accessory glands	1
44	Topic 46. Female reproductive system 1. General characteristics and functions of the organs of the female reproductive system 2. Sources of development of the organs of the female reproductive system 3. Morphofunctional characteristic of the ovary. Endocrine function of ovary. Ovogenesis 4. Structure of the uterus and fallopian tubes 5. Structure of the mammary glands	1
Total:		36

4.2. Plan of practical classes

№ 3.п.	TOPIC	Number of hours
INFORMATION BLOCK 1 CYTOLOGY AND EMBRYOLOGY		
1	Topic 1. Optical devices. Rules for working with a microscope. Special methods of research in cytology, embryology, histology.	2
2	Topic 2. The general organization of the cell. Plasmolemma. Intercellular contacts	2
3	Topic 3. Cytoplasm. Cell metabolism. Synthetic cell apparatus	2
4	Topic 4. Nonmembrane organelles	2
5	Topic 5. Inclusion - definition, classification, meaning	2
6	Topic 6. Cell nucleus	2
7	Topic 7. Reproduction of cells. Cell cycle. Mitosis	2
8	Topic 9. Aging and death of cell	2
9	Topic 10. Cell anomalies	2
10	Topic 11. Fundamentals of embryology. Progenesis. Fertilization. Implantation. Formation of extra-embryonic organs	2

11	Topic 12. Early stages of development of embryo	2
12	Topic 12. Provisional organs. Placenta. Umbilical cord	2
13	Topic 13. Control of the information block №1	2
INFORMATION BLOCK 2 GENERAL HISTOLOGY		
14	Topic 14. General principles of tissue organization. Epithelial tissue. Covering epithelium.	2
15	Topic 15. Glandular epithelium.	2
16	Topic 16. Blood. Erythrocytes. Hemogram.	2
17	Topic 17. Leukocytes. Leukocytic formula.	2
18	Topic 18. Platelets Hemopoiesis.	2
19	Topic 19. Loose connective tissue. Dense connective tissue.	2
20	Topic 20. Connective tissue with special properties.	2
21	Topic 21. Skeletal connective tissue: cartilaginous tissue.	2
22	Topic 22. Skeletal connective tissue: bone tissue.	2
23	Topic 23. Muscle tissue: smooth, striated skeletal and cardiac muscle tissue.	2
24	Topic 24. Nervous tissue. Neurons end neuroglia.	2
25	Topic 25. Nervous tissue. Nerve fibers and nerve endings. Regeneration of nerve fibers.	2
26	Topic 26. Control of the information block №2	2
INFORMATION BLOCK 3 SPECIAL HISTOLOGY AND EMBRYOLOGY		
27	Topic 27. Nervous system. Spinal cord.	2
28	Topic 28. Nervous system. Brain.	2
29	Topic 29. Peripheral nervous system Autonomic nervous system	2
30	Topic 30. Sensory system. Organ of vision	2
31	Topic 31. Sensory systems Organ of hearing and balance	2
32	Topic 32. Sensory systems. Organ of taste. Organ of smell	2
33	Topic 33. Endocrine system. Organs of the central endocrine system	2
34	Topic 34. Endocrine system. Organs of the peripheral endocrine system	2
35	Topic 35. Cardiovascular system. Blood vessels. Microcirculatory bed	2
36	Topic 36. Cardiovascular system. Heart. Lymphatic vessels	2
37	Topic 37. Central and peripheral organs of hematopoiesis and immune defense	2
38	Topic 38. Respiratory system	2
39	Topic 39. Skin and its derivatives	2
40	Topic 40. General description of organs of the digestive system. Organs of oral cavity	2
41	Topic 41. Digestive system: pharynx, esophagus, stomach	2
42	Topic 42. Digestive system: small and large intestine	2
43	Topic 43. Glands of the digestive tract: salivary glands, pancreas, liver	2
44	Topic 44. Urinary system	2
45	Topic 45. Male reproductive system	2
46	Topic 46. Female reproductive system	2
47	Topic 47. Control of the information block №3	1
	Total:	93

Note. * Plan of each practical lesson:

1. Oral interview on all material of the topic;
2. Working with microscopes and studying specimens;

3. Written solution of test problems "Step-1" on the topic;
4. Group work on errors;
5. Assessment of knowledge and notification of assessments.

4.3. Tasks for independent work

№	Topic	Number of hours
INFORMATION BLOCK 1 CYTOLOGY AND EMBRYOLOGY		
1	Preparation for practical classes (theoretical training, development of practical skills)	10
2	Independent study of topics that are not included in the classroom plan: Histology in Ukraine Methods of research in histology. Technology of manufacturing of histological preparations. Mechanisms of reception Structural bases of cytoprotection Changes in the endoplasmic reticulum in pathology Changes in the Golgi apparatus in pathology Changes in mitochondria in pathology Lysosomes. Changes in lysosomes in pathology. Lysosomal diseases Mytosis and meiosis Cell reaction to external stimuli	 2 2 3 3 2 2 2 2 2 2 2
INFORMATION BLOCK 2 GENERAL HISTOLOGY		
3	Preparation for practical classes (theoretical training, development of practical skills)	10
4	Independent study of topics that are not included in the classroom plan: General principles of tissue organization Epithelium as a leading component of histohemic barriers Epithelial stem cells. Thrombosis. Stages and Mechanisms. Leukocytes. Mechanisms of adhesion, migration, and keeling of microorganisms. Interaction of blood cells and connective tissue with inflammation Repair of loose fibrous connective tissue. Regulation of the volume and composition of the matrix of the connective tissue. Articular cartilage Bone as an organ. Bone remodeling. Regeneration of bone tissue Muscle as an organ. Muscle regeneration. Nerve endings. Nerve-muscle spindle..	 2 2 2 3 3 3 3 2 3 3 2 3 3 2 2 3
5	Preparing for the final control 1	6
Total:		81
INFORMATION BLOCK 3 SPECIAL HISTOLOGY AND EMBRYOLOGY		
6	Preparation for practical classes (theoretical training, development of practical skills)	10

7	Independent study of topics that are not included in the classroom plan:	
	Development of the nervous system	1
	Regeneration of nerves	1
	Eye development	1
	Development of the ear	1
	Development of the cardiovascular system.	1
	Morphological basis of neurohumoral regulation of blood vessels activity.	1
	Development of endocrine glands.	1
	Diffuse endocrine system.	1
	Trans- and parathyroid regulation.	1
	Embryogenesis of the hematopoiesis.	1
	Cellular basis of non-specific immunity.	1
	Cellular basis of reactions of cellular and humoral immunity	1
	Nerve endings of the skin, their role in the work of the statokinetic system.	1
	Development of the oral cavity and organs of the digestive system.	1
	Structural bases of digestion.	1
	Neurohumoral regulation of digestion.	1
	Intestinal-associated lymphoid tissue.	1
	Development of digestive glands.	1
	Regulation of secretory activity and regeneration of digestive glands.	1
	Development of the respiratory system.	1
	Neurohumoral regulation of mucociliary apparatus and bronchial tone.	1
	Development of the urinary system.	1
	Structural bases of urine concentration.	1
	Development of organs of the male reproductive system.	1
	Structural and molecular criteria for the diagnosis of male infertility.	1
	Development of organs of the female genital system.	1
	Regulating the ovarian-menstrual cycle.	1
	Mechanisms of placental development.	1
	Regularities of organogenesis	1
8	Preparing for the final control 2	6
	Total::	45

Individual tasks

The individual task is chosen by the student at the beginning of studying of the information block and is specified together with the teacher. If necessary, the teacher provides counseling and makes corrections to the work. Completed task is given to the teacher before the beginning of the final control. The evaluation of the work is conducted by the teacher in accordance with the distribution of the maximum number of points

Note: An individual modular task is not required.

Typical test problems to be solved in practical classes:

1. During the staining of specimens, various acidic and basic dyes are used. By origin they are divided into plant, animal, synthetic. Determine which of the following dyes by origin belongs to the animal?

- A. Carmine
- B. Azur

- C Fuchsin
- D. Hematoxylin
- E. Methylene blue.

2. Microspecimen analysis of child's finger skin revealed that epidermis has signs of inadequate development. What embryonal leaf was damaged in the process of development?

- A Ectoderm
- B Mesoderm C
- Endoderm
- D Mesenchyme

3. Tumor of the pericardium was diagnosed in the man. What epithelium is a source of tumor development?

- A Simple squamous
- B Pseudostratified epithelia
- C Transitional
- D Stratified epithelium keratinized

4. During examining ophthalmologist found out that the patient does not distinguish blue and green, with normal perception of other colors. Dysfunction of what retinal structures is that?

- A Cones-shape cells
- B Rod-shape cell
- C Bipolar neurons
- D Amacrine neurons

5. 30 years old patient was diagnosed with thyroid gland hyperfunction. What shape do follicular cells have in the follicles?

- A. Columnar
- B. Polygonal
- C. Squamous
- D. Spindle

4.4. Ensuring the educational process

Optical devices:

Micromed 2 - 7 pc

Biolam - 1 pc

Binocular Micromed - 1 pc

In total - 9 pcs

Micropreparations (100 pieces) according to the list

Slides on the topics of practical classes - 1 set.

Tables on the topics of practical classes and lectures - 1 set.

Demonstration screens, laptops, files in Power Point and Word with tasks "Step-1" for practical and final classes.

Exam tickets

5. Final control

List of final control (exam) questions

INFORMATION BLOCK 1 CYTOLOGY AND EMBRYOLOGY

1. Cytology. Definition, tasks, importance for biology and medicine
2. Cell theory. The history of the problem Substantive provisions
3. Cell surface complex. Membrane, suprimembranous and diaphragm components Their structure and functions. Intercellular contacts, their types, structure and functions.
4. Cell as an elemental living system of a multicellular organism. Definition. The superficial complex of the cell. Its structure and functions
5. Metabolic apparatus of the cell. Its structural composition. Organelles of general importance Classification, structure and general characteristics
6. Cell nuclear apparatus, its value. Main components of the kernel, their structural and functional characteristics. Nuclear-cytoplasmic relationships as an indicator of the cell's functional state
7. Cell membranes. Modern understanding of their structure, properties and functional significance
8. Cell as elemental living system. Definition. Membrane organelles. Golgi Complex. Structure and Functional Value
9. Eukaryotic cells. General structure. Granular and non-granular endoplasmic reticulum. Structure and functions
10. Cell as elemental living system. Definition. General-purpose organelles. Mitochondria, structure, functional value
11. Cell is an elementary living system. Definition. The general plan of structure. Lysosomes. Structure, functional value
12. Cell as elemental living system. Definition. General plan for the construction of eukaryotic cells. Non-membrane organelles of the cytoplasm. Structure, functional value
13. Cell as elemental living system. Non-membrane organelles. Centrosome (cell center). Structure, functional value
14. Cell as an elemental living system. Exercise. The general plan of structure. Inclusion of the cytoplasm. Their classification and value
15. Cell cycle: its stages, morphofunctional characteristics, features in different cell types.
16. Methods of cell reproduction. Their morphological characteristics. Values for biology and medicine
17. Mitosis. Its importance, phases and regulation. Mitotic and interphase chromosomes
18. Mitosis. Its regulation. The value of mitosis for the biology of medicine
19. Mitosis. General characteristics of the different phases. The concept of endoreproduction and polyploidy
20. Meiosis. Its significance. Difference from mitosis
21. Cell growth, differentiation, aging and death. Response of cells to external influences
22. Embryology. Content. Scientific directions. Values for biology and medicine
23. Types of eggs, the nature of their crushing after fertilization.
24. Gastrulation. Definition of the concept. The biological significance of the first and second stages gastrulation. Characterization of different types of gastrulation
25. Stages of embryogenesis. Gastrulation, its value. Comparative characteristic of gastrulation in chordates and humans
26. Embryonic leaves. Definition of the concept. Mesoderm and mesenchyme, their derivatives
27. Embryonic leaves. Definition of the concept. Ectoderm and endoderm, their derivatives
28. Axial complex of organs in vertebrates and its development

29. The germ cells. Morphological and functional characteristics of sperm and oocytes.
Fertilization
30. Early stages of human development. Features of crushing. Morula, blastocyst and its implantation
31. Early human embryogenesis. Formation of germinal leaves. The concept of germinal rudiments
32. Early human embryogenesis. Formation of transient organs (chorion, yolk and amniotic vesicles, allantois)
33. Human embryo at 4 weeks of development. Formation of nerve tube, somites and intestinal tube
34. The system «mother-fruit». Features of placental circulation. The structure of the umbilical cord
35. Implantation. Placenta. Mammalian placental types
36. Relationship of the human embryo with the maternal organism. Placenta and umbilical cord
37. The placenta and its formation, structure and function
38. The concept of critical periods of human embryo development
39. The main stages of human embryonic development. Embryonic induction as one of the regulating mechanisms of embryogenesis

INFORMATION BLOCK 2 GENERAL HISTOLOGY

1. Tissues. Definition of the concept. Classification. Contribution by O.O. Zavarzin and M.G.Khlopinin the development of the doctrine of tissue
2. Tissues as one of the levels of living organization. Definition. Classification of types. The concept of tissue determination and differentiation
3. The concept of diférons and stem cells.
4. Tissues as one of the levels of living organization. Definition. Cellular derivatives (syncytia and symplasts, intercellular substance)
5. Tissues. Definition. Physiological and reparative regeneration of different tissue types.
6. Epithelial tissues. General characteristics. Morphofunctional and genetic classification of their types
7. Epithelial tissues. Morphofunctional characterization of different types of epithelial cover
8. Glandular epithelium. Classification and structure of glands. Morphology of the secretory cycle. Types of glandular secretion
9. Embryonic hemocytopoiesis. Blood development as a tissue. Features of yolk and hepatic hematopoiesis
10. Postembryonic hematopoiesis. Modern scheme of hematopoiesis
11. Hemopoiesis in the post-embryonic period. The relationship of stromal and hematopoietic elements
12. Hemogram. Leukocyte formula, its value for the clinic. Erythrocytes, structure and functional value
13. Hemogram and leukocyte formula. Platelets, their number, function, duration of existence
14. Thrombocytopoiesis. Structure and function of platelets
15. Leucocyte formula. Leukocytopoiesis in embryonic and post-embryonic periods.
16. Leukocytes. Classification, morphofunctional characteristics. Leukocyte formula and its features at different stages of ontogeny
- 17.. Blood leukocytes. Basophilic and eosinophilic granulocytes

18. Leucocyte formula. Morphofunctional characterization of monocytes. The concept of the system of mononuclear phagocytes
19. Macrophages and lymphocytes. Their structure, histochemical characteristics and participation in immune response
20. Characterization of immunocompetent cells. T and B lymphocytes. Their development, proliferation and differentiation
21. Fibrous connective tissue. Its structure, varieties and functional significance. Intercellular substance formation (for example collagen synthesis)
22. Intercellular substance of connective tissue (fibers, basic substance), structure, value
23. Intercellular substance of connective tissue. Collagen and elastic fibers. Their structure and functions
24. Connective tissue cells. Structure, functional value
25. Loose fibrous connective tissue. Morphofunctional characteristics. Macrophagocytes: structure and sources of development. The concept of the system of mononuclear phagocytes
26. Dense fibrous connective tissue. Morphofunctional characteristics. Structure of dense fibrous connective tissue (for example tendon)
27. Macrophagocytes: morphofunctional characteristics, their participation in natural and acquired immunity. The concept of the system of mononuclear phagocytes
28. Cellular elements of connective tissue. Macrophagocytes, plasma cells and their participation in the body's protective reactions
29. Connective tissues with special properties (reticular, fat, pigment, mucous). Structure and functional value
30. Cartilage, their classification, structure and function. Cartilage development, their regeneration and age-related changes
31. Bone tissue. Classification of types. Morphofunctional characteristics
32. Reticulofibrous bone tissue. Its histogenesis, structure, regeneration and age changes
33. Plate bone tissue. Tubular bone. Structure, development, regeneration
34. Plate bone tissue. General Morphofunctional characteristics. Tubular bone regeneration and factors that affect bone structure
35. Muscle tissue. Sources of development. General morphofunctional characteristics. Non-stained muscle tissue. Histogenesis, structure, regeneration
36. Muscle tissue. Sources of development, general morphofunctional characteristics. Striped muscle tissue. Structure, innervation, structural basis of reduction. Regeneration
37. Skeletal muscular tissue. The concept of red and white muscle fibers. Muscle structure as an organ.
38. Cardiac muscle tissue. Development, microscopic and ultramicroscopic structure
39. Nerve tissue. Morphofunctional characteristics. Sources of development. Neurons. Morphological and functional classification
40. Neuroglia. Classification, structure and significance of different types of neuroglia
41. Nerve fibers. Morphofunctional characteristics of myelin and demyelinated nerve fibers
42. Nerve endings. Classification of types. Morphofunctional characteristics of motor nerve endings
43. Nerve endings. Morphofunctional characterization of sensitive nerve endings
44. Nerve tissue. General characteristics. Interneuronal synapses, their structure and functions
45. Nerve tissue. Sources of development. Morphofunctional characteristics. The concept of simple and complex reflex arcs

INFORMATION BLOCK 3 SPECIAL HISTOLOGY AND EMBRYOLOGY

1. The nervous system. General morphofunctional characteristics. Classification. Sources of development
2. Spinal cord. Morphofunctional characteristics. Development. The structure of gray and white matter. Neural composition. The ascending and descending leading pathways of the spinal cord
3. Sensitive nerve nodes. Structure, functions and connections
4. Autonomous (autonomic) nervous system. The structure of extra- and intramural ganglia. Classification of neurocytes by O.S. Dogel
5. Peripheral nerve. Structure, degeneration and regeneration after damage
6. The cerebellum. Structure and functional characteristics. Neuronal composition and gliocytes of cerebral cortex
7. The brain. General Morphofunctional characteristics. Cyto- and myeloarchitectonics of the cortex. Age changes
8. The brain. The bark of the large hemispheres. Morphofunctional principle of neocortex organization
9. The senses. General morphofunctional characteristics. The organ of taste. Structure, development and cytophysiology
10. The senses. General morphofunctional characteristics. The sense of smell. Structure, development and cytophysiology
11. The eye. Embryonic development. The general plan of structure. Morphofunctional characteristics of the cornea and lens
12. The eye. Embryonic development. Dioptic apparatus of the eye (cornea, lens, vitreous body)
13. The eye. Embryonic development. The structure of the retina. Histophysiological characteristics of photoreceptor cells
14. The eye. Embryonic development. The retina of the visual, ciliary and iris parts. Histophysiological characteristics of photoreceptor cells
15. Hearing organ. Development, structure and histophysiology
16. Hearing organ. Sources of development. The structure of the outer, middle and inner ear. Histophysiology of the spiral organ
17. Body of balance and vibration. Sources of development. Structure and histophysiology
18. Skin. structure and sources of development. Features of the structure of thin skin
19. Skin. Sources of development. Structure and functions. Physiological regeneration of the epidermis. Features of the structure of oily skin
20. Derived skin (hair, nails, glands). Hair structure and function. Hair change.
21. Cardiovascular system. Morphofunctional characteristics. Classification of vessels. Relationship of hemodynamic conditions with the structure of blood vessels
22. The artery. Classification of types and their morphofunctional characteristics. Arteries of the muscular type
23. Arteries. Classification of types and their morphofunctional characteristics. Arteries of elastic and muscular-elastic types. Age changes
24. Vessels of hemomicrocirculatory bed. Morphofunctional characteristics of its links.
25. Arterio-venular anastomoses. Classification, structure of different types of anastomoses. their functions
26. Blood capillaries. The structure. The main types of capillaries. The concept of histogematic barriers

27. Vienna. Classification. Development, structure, functions. Structure dependence on hemodynamic conditions
28. Lymphatic vessels. Morphofunctional characteristics. Sources of development
29. Heart. The general plan of structure of a wall. Myocardium. Morphofunctional characterization of contractile and conductive cardiomyocytes
30. Heart. Sources of development. Histogenesis. The general plan of structure of a wall. Endocardium
31. Endocrine system. Classification of endocrine glands. The concept of target cells and hormone receptors
32. The endocrine system. Classification of endocrine glands. Characterization of single hormone-producing cells
33. The hypothalamus. Neurosecretory nuclei of the hypothalamus, features of the structure and function of neurosecretory cells. Hypothalamo-adeno-pituitary and hypothalamo-pituitary system themes
34. Pituitary gland. Development, structure, blood supply, histophysiology. Relationship of the pituitary gland with the hypothalamus
35. The pituitary gland. Development. The general plan of structure. Adenohypophysis, its blood supply, communication with the hypothalamus, functional significance
36. Pituitary gland. Development. The general plan of structure. Neurohypophysis, its blood supply, communication with the hypothalamus, functional significance.
37. The epiphysis. Sources of development. The structure. Secretarial functions
38. Thyroid gland. Development, structure, histophysiology, functional value. Age changes
39. Thyroid gland. Development, structure and functional value. Age changes
40. Adrenal glands. Sources of development. Structure, histophysiology of cortical and brain matter. Adrenal connection with the pituitary and central nervous system. Age changes
41. The digestive canal. The general plan of structure of a wall. Innervation and vascularization. Morphofunctional characteristics of the lymphoid apparatus
42. The oral cavity. Features of the structure of the mucous membrane of various organs of the oral cavity
43. Oral cavity. General characteristics of the mucous membrane. Lip and cheek. Development, structure, functions
44. Hard and soft palate. Development. General structure. Morphological features of the mucous membrane on different surfaces
45. Language. Development. The general plan of structure. Features of the structure of the mucous membrane on different surfaces
46. Large salivary glands, their classification, development. Parotid salivary gland, structure, functions.
47. The large salivary glands. General characteristics. Submaxillary and sublingual salivary glands
48. Teeth. The general plan of structure. Dentine. Development, structure, functions. The concept of transparent dentin and interglobular spaces
49. Teeth. The general plan of structure. Enamel. Structure, functions, development.
50. Tooth development. Cutting and replacement of teeth
51. The digestive canal. The general plan of structure of a wall. Throat and esophagus. Its structure and functions
52. The stomach. General morphofunctional characteristics. Sources of development. Features of the structure of different departments. Innervation and vascularization. Regeneration. Age changes

53. Gastric glands, their morphofunctional features in different parts of the body
54. The small intestine. Development. General morphofunctional characteristics. Histophysiology of the crypt-villus system
55. The colon. General morphofunctional characteristics. Sources of development. Structure, regeneration, age changes
56. The digestive canal. The general plan of structure of a wall. Morphofunctional characteristics of the endocrine apparatus
57. Worm-shaped process. General morphofunctional characteristics
58. Liver. General morphofunctional characteristic. Structure of hepatocytes, perisinusoidlipocytes and sinusoid wall
59. Liver. General morphofunctional characteristics. Sources of development. The structure of the classic liver lobe. Imagery of portal lobes and acinus. Regeneration. Age changes
60. Pancreas. Development. The general plan of structure. Histophysiology, regeneration, age-related changes
61. Pancreas. Development, general layout of the structure. The exocrine part, its structure and functions.
62. Respiratory system. Morphofunctional characteristics. Respiratory and nonrespiratory functions, airways. Structure and function of the nasal cavity lining
- 63.. Respiratory system. Morphofunctional characteristics. Airways. Sources of development. The structure and functions of the trachea and bronchi of different caliber
64. Lungs. Morphofunctional characteristics. Sources of development. The structure of the respiratory department. Aerogematic barrier. Particularly blood supply. Age changes
65. Structure and histophysiology of the lung acinus
66. Concept about the immune system and its tissue components. Classification and characteristics of immunocytes and their cooperation in the reactions of humoral and cellular immunity.
67. Heamatopoesis. Concept about the stem and semistem cells of haematopoetic tissues. The modern scheme of hematopoiesis.
68. Red and yellow bone marrow. Structure and functions. Characteristics of postembryonic haematopoesis in red bone marrow. Cooperation stromal and haematopoetic elements.
69. Organs of haematopoesis and immune defence. Thymus. Structure and function. Characteristics of post-embryonic haematopoesis in thymus. Aging and accidental involutions of the thymus.
70. Spleen. Structure and function. Features of embryo and post-embryonic haematopoesis in a spleen. T- and B-zons.
71. Lymphatic nods. Structure and function. T- and B-zon of lymphatic nods.
72. Urinary system, its morphofunctional characteristics. The kidneys. Sources and main stages of development. Structure and features of blood supply
73. The kidneys. Structure and functional significance of cortical cortical nephrons
74. The kidneys. The general plan of structure. The endocrine apparatus of the kidney. Structure and function
75. Urinary tract. Development. Structure and Functional Value. Mucous epithelium (urothelium)
76. The testicle. The structure. Embryonic and post-embryonic histogenesis. Functions. Spermatogenesis and its regulation
77. The testicle. The structure. Embryonic and post-embryonic histogenesis. The concept of hematotesticular barrier

78. The uterine tract and accessory glands of the male reproductive system. Appendix of the testicle. Family bubbles. The prostate gland. Structure, functions. Age changes
79. The ovary. Embryonic and post-embryonic histogenesis. Structure and function. Ovogenesis and its regulation
80. The ovary. Embryonic and post-embryonic histogenesis. Common rail structure. Endocrinal function of the ovary. Age changes
81. The uterus. Development. Structure and functions. Cyclic changes, hormonal regulation. Age changes
82. Organs of the female genital system. Fallopian tubes and vagina. Changes during the ovarian menstrual cycle, their hormonal regulation
83. Breast. Development, structure and functions. Hormonal regulation of the breast

«0» version of the exam ticket

BLACK SEA STATE UNIVERSITY OF A NAME OF PETRO MOHYLA

Educational qualification level - master

Branch of knowledge: 22 Health

Specialty 222 Medicine

EDUCATIONAL DISCIPLINE - HISTOLOGY, CYTOLOGY AND EMBRYOLOGY

Option № 0

Theoretical part:

1. Skin. Structure and functions. Physiological regeneration of the epidermis. **The maximum number of points - 30.**

2. Parathyroid gland: structure, histophysiology, functional value. **The maximum number of points - 30.**

Practical part:

3 Identify the proposed histological preparation. **The maximum number of points - 20.**

Approved at the meeting of the Department of Medical Biology and Physics, Microbiology, Histology, Physiology and Pathophysiology №__ from __ 202__

Head of the Department _____ Korolova O.V

Examiner _____ Pshychenko V.V

An example of the final control work on block 1

Solving problems Step-1

1. For the person it is diagnosed galactozemia - illness of accumulation. As a result of infringement of what cellular structure there was this illness?

- A Golgy complex
- B Centrioles
- C Lisosomes
- D Mitochondrias

2. The tumor cell culture was treated with colchicine, which blocks the formation of tubulin proteins that form the spindle. What stages of the cell cycle will be disrupted?

- A Mitosis.
- B Presynthetic period
- C Synthetic period
- D Post-synthetic period
- E Interphase

3. At microscopic research of embryo bodies which are removed during operation, the germ consists of two blastomeres has been found. Name a place of its localization in condition of normal embryo's development.

- A. Ampullary part of the uterine tube
- B. Uterine tube near uterus
- C. Uterine cavity
- D. Abdominal cavity

And so 20 problems with the subsequent analysis of typical mistakes

**Example of the final control work for Block 2
Solving problems Step-2**

1. In a blood smear of a person suffering from allergy, one can observe a large number of cells of spherical form with segmented nucleus and with large bright pink granules in the cytoplasm. Which blood cells are these?

- A Eosinophils
- B Neutrophils
- C Monocytes
- D Basophils

2. During the training an athlete was injured lower extremity. Traumatologist diagnoses the rupture of tendon. What type of connective tissue does tendon belong to?

- A Dense regular connective tissue
- B Dense irregular connective tissue
- C Loose connective tissue
- D Cartilage

3. Damaged nervous fibers capable regenerate their integrity. What neuroglia cells take active place in it?

- A. Oligodendrocytes
- B. Microglia
- C. Ependymal cells
- D. Fibrous astrocytes

And so 20 problems with the subsequent analysis of typical mistakes

**Example of the final control work for Block 3
Solving problems Step-3**

1. The boxer does not sense smell after nose trauma. Damage of what cell can lead to loss of smell?

- A Neurosensory cells

- B Supporting epithelial cells
- C Basal epithelial cells
- D Ciliated epithelial cells
- E Goblet cells

2. A 46-year old patient was admitted to the immunological department. Disorders of granulopoiesis and thrombopoiesis were found. In which of the following organs do these pathological process occur?

- A Red bone marrow
- B Thymus
- C Spleen
- D Lymph node
- E Palatine tonsils

3. 30 years old patient was diagnosed with thyroid gland hyperfunction. What shape do follicular cells have in the follicles?

- A Columnar
- B Polygonal
- C Squamous
- D Spindle
- E Cuboidal

And so 20 problems with the subsequent analysis of typical mistakes

6. Criteria for evaluation and tools for diagnosing learning outcomes

Control methods include current, intermediate and final control.

Current control is carried out during practical classes and has the goal of checking the student's level of preparation for specific work.

Forms of current control during practical classes:

- oral questioning (testing of theoretical knowledge and practical skills);
- test control on the topic of the lesson;
- consideration of situational tasks "Step 1" with an explanation of the correct answer;
- reproduction of images of histological specimens in albums with the pointing of their

structures.

Intermediate control. Checking the possibility of students using the obtained theoretical knowledge and practical skills on all topics studied, as well as the results of independent work of students, for clinical and diagnostic analysis. Carried out at the last lesson on the information block by passing practical skills, solving situational problems and testing.

The final control is carried out at the last practical lesson after the completion of the study of all topics of the block at the last control lesson of the semester. The control of theoretical knowledge, acquired practical skills and abilities is carried out. The maximum number of points of the final control is equal to 80. Students who have attended all the lectures and classroom training sessions provided for in the curriculum, completed full independent work and scored at least the minimum number of points in the course of training are allowed to participate in the final control (exam). Distribution of points received by students

The grade for the discipline is set as the average of the grades for the topics of the three blocks on which the discipline is structured, only for those students who have all the blocks.

The maximum number of points assigned to students in mastering each block (credit) and the discipline as a whole - 200, including for current educational activities - 120 points (60%), the results of the final control - 80 points (40%).

Accordingly, in the first semester, the maximum score in the practical lesson is: 120 points: 32 lessons = 3.75 points; in the second semester - 120: 15 = 8 points. At the test or exam, a student can get a maximum of 80 points.

In order to assess the results of training in Histology, Cytology and Embryology, the final control is carried out in the form of an exam, which is recommended for academic disciplines that are part of the integrated test examinations EDKI and "Step-2". Only students who have passed both final tests (blocks 1-3) in the discipline are admitted to the exam.

Distribution of points awarded to students:

INFORMATION BLOCK 1	Number of points
Topic 1	3,75
Topic 2	3,75
Topic 3	3,75
Topic 4	3,75
Topic 5	3,75
Topic 6	3,75
Topic 7	3,75
Topic 8	3,75
Topic 9	3,75
Topic 10	3,75
Topic 11	3,75
Topic 12	3,75
Topic 13	3,75
INFORMATION BLOCK 2	Number of points
Topic 14	3,75
Topic 15	3,75
Topic 16	3,75
Topic 17	3,75
Topic 18	3,75
Topic 19	3,75
Topic 20	3,75
Topic 21	3,75
Topic 22	3,75
Topic 23	3,75
Topic 24	3,75
Topic 25	3,75
Topic 26	3,75
Topic 27	3,75
Topic 28	3,75
Topic 29	3,75

Topic 30	3,75
Topic 31	3,75
Topic 32	3,75
Final control work on block 1-2	80
Total sum of points	120
Total for Block 2	200

INFORMATION BLOCK 3	Number of points
Topic 33	8,0
Topic 34	8,0
Topic 35	8,0
Topic 36	8,0
Topic 37	8,0
Topic 38	8,0
Topic 39	8,0
Topic 40	8,0
Topic 41	8,0
Topic 42	8,0
Topic 43	8,0
Topic 44	8,0
Topic 45	8,0
Topic 46	8,0
Topic 47	8,0
Exam	80
Total sum of points	120
Total for Block 3	200

The minimum number of points that a student can score for the current educational activities in the study of the unit to be admitted to the final control - 70. Accordingly, in the first semester, the minimum score in the practical lesson is: 70 points: 32 classes = 2.2 points; in the second semester - 70: 15 = 4.7 points; A test or exam is credited to a student if he has scored at least 50 points. Accordingly, the minimum score for the discipline as a whole is: 70 + 50 = 120 points.

Assessment of independent work is carried out during the current control of the topic in the relevant classroom. Assessment of mastering the topics that are submitted only for independent work and are not included in the topics of classroom training, is controlled during the final control.

Exam Evaluation Criteria

«**Excellent**» (maximum 80 points) - meaningful answers and an understanding of the entire curriculum material. Consistent, reasonable and error-free presentation of the material using medical terminology. Independent, confident and correct application of the acquired knowledge to solve practical problems. The student is well-versed in subject terminology. Clearly formulates the answers to the questions raised. Practical skills are performed in full.

«**Good**» (maximum 70 points) - knowledge and understanding of all program material. Reasonable presentation of the material with minor deviations. The student correctly and without much difficulty applies theoretical knowledge in solving practical problems, but makes minor mistakes, which he corrects by answering questions. Practical skills are not fully implemented.

«**Satisfactory**» (from 60 to 50 points) - knowledge and understanding of all program material in an amount that is satisfactory to conduct further work. Simplification of the presentation of the material with minor errors that do not affect the overall result. Application of acquired knowledge to solve practical problems with difficulties. The student's answer is evaluated on the condition that he knows the main theoretical provisions.

«**Unsatisfactory**» (less than 50 points) - a misunderstanding of most of the program material, its presentation with serious errors. Application of acquired knowledge with the assumption of gross errors that affect the final result. The student is unable to answer leading questions and uses inaccurate wording. He doesn't have any practical skills.

7. Recommended sources of information

7.1. Basic

1. Yeroshenko G.A., Vilkhova O.V., Yakushko O.S., Skotarenko T.A. General histology in figures and diagrams. Textbook for students of the Faculty of training international students in specialty 222-Medicine. – Poltava: TOB HBП «Укрпромторгсервіс», 2020. – 126 c.

2. Pawlina W, Ross M. Histology: a Text and Atlas with Correlated Cell and Molecular Biology. 8th edition. Wolters Kluwer. 2019. – 928 p.

3. Junqueira LC, Carneiro J. Basic histology. 11 edition. 2005.

4. Carlson BM. Human Embryology and Developmental Biology. 5th edition, Saunders Elsevier. 2013.

5. Gartner LP, Hiatt JL. Color Atlas and Text of Histology. 6th edition. Wolters Kluwer. 2014.

6. Shepitko V.I., Yeroshenko G.A., Lysachenko O.D., Yakushko O.S. Cytology and General Histology. Textbook for students of the Faculty of training foreign students in the specialty «Medical science». Poltava, 2014. 114 c.

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3. Dongmei Cui, John P. Naftel, Jonathan D. Fratkin, William Daley, James C. Lynch. Atlas of Histology: With Functional and Clinical Correlations, Lippincott Williams and Wilkins. 2010.

4. Lowe J., Anderson P. Stevens & Lowe's Human Histology, 4th Edition. Elsevier Health Sciences. 2014.

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9. Mescher A.L. Junqueiras basic histology. Text and atlas. 13 th. Ed. New York, Mack Graw Hill. 2013. 559 p.

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7.3. Information resources on the Internet

1. Anatomy-Histology Tutorials -
<http://library.med.utah.edu/WebPath/HISTHTML/HISTOTCH/HISTOTCH.html>
2. An Introduction to Specimen Preparation -
<http://www.leicabiosystems.com/pathologyleaders/an-introduction-to-specimen-preparation/>
3. Histology Lectures - <http://www.kasem.info/histology-lectures/dental-histology-lectures/cell-nucleus>
4. Illustrations - <http://www.gettyimages.com/photos/nucleus>
5. Embryology (education and research website) -
<https://embryology.med.unsw.edu.au/embryology/index.php/Histology>
6. Illustrations cards - <https://quizlet.com/108067553/types-of-connective-tissue-flash-cards/>
7. Nervous Tissue - <http://philschatz.com/anatomy-book/contents/m46509.html>