SYLLABUS

1. General information on the course

Full course name	Histology, Cytology and Embryology
Full official name of a higher education institution	Sumy State University
Full name of a structural unit	Medical Institute. Кафедра морфології
Author(s)	Tymakova Olena Oleksandrivna, Bumeister Valentyna Ivanivna, Kiptenko Liudmyla Ivanivna
Cycle/higher education level	The Second Level Of Higher Education, National Qualifications Framework Of Ukraine – The 7th Level, QF-LLL – The 7th Level, FQ-EHEA – The Second Cycle
Semester	16 weeks across 1 semester, 18 weeks across 2 semester
Workload	12 ECTS, 360 hours, out of which 158 hours are working hours with the lecturer (22 hours of lectures,136 hours of seminars)
Language(s)	English

2. Place in the study programme

Relation to curriculum	Compulsory course available for study programme "Medicine"
Prerequisites	There are no specific pre-requisites
Additional requirements	There are no specific requirements
Restrictions	There are no specific restrictions

3. Aims of the course

The aim of the discipline is for students to acquire modern constructive thinking and systems of specialized knowledge in the field of histology, cytology, and embryology, as well as achievements modern level of fundamental and clinical thinking. Get the basic principles of histological diagnostics.

4. Contents

Module 1. Module I. «Cytology»

Topic 1 History of development histology, cytology and embryology. Histological technique. The aim and tasks of cytology.

The emergence of histology, cytology and embryology as separate sciences. The value of the research of R. Hooke, A. Levenguk, J. Purkinje, R. Brown, M. Schleiden, T. Schwann for the creation of cell theory. Cell theory is both the basis of biology and the basis for the development of embryology, histology, physiology. Systematization of information about the microscopic organization and development of cells, tissues, organs. The current state of development of histology, cytology and embryology, its achievements, problems, prospects. Relationship of histology with other sciences of medical and biological profile. Microscopic research methods in histology are as basic. Principles of manufacturing drugs for light and electron microscopy: obtaining material, fixation, dehydration, processing, embedding, sectioning on microtome and ultramicrotome. Types of histology specimens. The concept of different staining. Microscopy technique, the concept of resolution. Special methods of light microscopy. Transmission and scanning electron microscopy. The concept of histochemical, immunocytochemical and radioautographic metods. Vital research methods. The aim and tasks of cytology, its significance for medicine.

Topic 2 The structure of the cell.

The concept of the cell as an elementary living system. General morphology of the eukaryotic cell. Modern idea of the elementary biological membrane as the basis of the receptor-barrier-transport system of the cell (plasmolemma). Functions and structure of plasmolemma. The basic components of the cytoplasm - hyaloplasm, organelles, inclusions. Organelles - definitions, classifications. Organelles of the general importance. Organelles of the special importance. Inclusion - definition, classification. The value of the nucleus in the life of a eukaryotic cell. Shape, size, number of nuclei and nuclear-cytoplasmic ratio in different types of cells. The main components of the nucleus: nuclear envelope, chromatin, nucleolus, nuclear matrix. Nuclear envelope, its structural and functional organization: membranes, perinuclear sinternal space, nuclear pores. Chromatin, chemical composition. Chromatin as an interphase state of chromosomes, sex chromatin. The concept of euchromatin and heterochromatin. Levels of chromatin packing. Structure and function of chromosomes and cell division. Karyotype. The nucleolus, as a derivative of chromosomes. The structure of the nucleolus and its role in chromosome formation.

Topic 3 Cell reproduction. Aging and death of the cell.

Cell cycle, its periods. Types of cells that come out of the cell cycle. Methods of cell reproduction: mitosis, amitosis, endomitosis, meiosis. Intracellular regeneration, general morpho-functional characteristics, biological significance. Reactions of cells to the damaging effect. Reversible and irreversible cell changes. Their morphological manifestations. Adaptation of cells, its importance for preserving the life of cells in altered living conditions. Apoptosis and its biological and medical significance. Aging and cell death.

Topic 4 The test control of the Module I «Cytology».

The test and theoretical control of topics 1-3. Control of practical skills on topics 1-3.

Module 2. Module II. «Basic and comparative Embryology»

Topic 5 Bases of general embryology.

The aim and tasks of embryology, significance for medicine. Research methods. History of embryology. Theories of embryogenesis: preformism, epigenesis, neopreformism. The main stages of embryo development. The concept of biological processes underlying the development of the embryo: induction, determination, division, cell migration, growth, differentiation, cell interaction. Germ cells. Types of oocytes. Fertilization, phases, its biological significance. Zygote as a unicellular organism. Cleavage, its definition. Methods of cleavage in different classes of vertebrates. Cleavage of the human embryo, chronology of the process. Types of blastulas. Morula. Formation of blastocoele. Embryoblast and trophoblast. Gastrulation, its definition. Methods of the first phase of gastrulation in different classes of vertebrates. Features of gastrulation in humans. Structures formed as a result of the first phase of gastrulation. Epiblast and hypoblast. Presumptive rudiments at the stage of primary strip formation. The second phase of gastrulation in humans. Formation of embryonic mesoderm. Neurulation and formation of the axial complex of organs. Differentiation of embryonic layers and their derivatives.

Topic 6 Extraembryonic (provisional) organs.

Provisional organs in different classes of vertebrates. Provisional organs in humans: chorion, amnion, yolk sac, allantois, umbilical cord. Their structure and significance. Types of placentas in different classes of vertebrates, their structure. Human placenta, its development, structure and functions. Changes in the endometrium during pregnancy, amniotic tunics . The mother-fetus system. The concept of critical periods of embryogenesis and ontogenesis. The concept of in vitro fertilization, its medical and social significance.

Topic 7 The test control of the Module II «Basic and comparative Embryology».

The test and theoretical control of topics 5-6. Control of practical skills on topics 5-6.

Module 3. Module III. «General Histology»

Topic 8 Basic principles of organization of tissues. Epithelium tissues.

The definition of "tissue". Classification of tissue types. The concept of determination and differentiation of tissues, their molecular genetic bases. Physiological, reparative regeneration and metaplasia of various types of tissues. General morphofunctional characteristics of epithelial tissue. Cytokeratines as markers of different types of epithelial tissues. Genetic and morphofunctional classification of epithelial tissues. The structure, function and localization of simple epithelium. The structure of stratified epithelium. Physiological and reparative regeneration of epithelial tissues. The structure and classification of the glandular epithelium. Morphology of the secretory cycle. Types of glandular secretion.

Topic 9 Internal environment tissues.

General morphofunctional characteristics of internal environment tissues. General characteristics of blood and its components as one of the types of tissues of the internal environment. Blood plasma, it's composition and function. Formed blood elements, their classification. Leukocyte formula and hemogram, features in newborns and children of different ages. Lymph, it's composition and function. Hemocytopoiesis. The modern scheme of hematopoiesis. Postembryonic and embryonic hemocytopoiesis, its features. Loose connective tissue, it`s localization, classification, structure and functions. General characteristics of loose fibrous connective tissue, its cellular composition. The chemical composition and function of the extracellular substance. The structure and functions of fibers. The structure and functions of dense connective tissue. Location, structure and functions of the regular and irregular dense connective tissue. The structure of the tendon. Characterization of connective tissue with special properties. Cartilage tissues. The general plan of the structure of cartilage tissue. Histogenesis of cartilage. General characteristics of bone tissue. The structure of the bone as an organ. Development of bones.

Topic 10 Specialized connective tissue. Muscles tissues. Nervous tissue.

General morphological characteristics and classification of muscles tissues. Skeletal muscle tissue. The contractile apparatus of skeletal muscle tissue. Smooth muscle tissue, localization, structure and functional features. Morphological and functional characteristics of the nervous tissue. Histogenesis of nerve tissue. Morphological and functional classification of neurons. General and special organelles of neurons. The functional value of the processes of nerve cells. Neuroglia. Characterization and classification. Macroglia, it`s function and localization. Characterization of microglia, function and localization. Nerve fibers and nerve endings, their microscopic structure. Regeneration of nerve tissue. Receptor and effector nerve endings, their classification. Synapses, their classification. Mechanisms of transmission of a nerve impulse. The structure of simple and complex reflex arcs.

Topic 11 The test control of the Module III «General Histology».

The test and theoretical control of topics 8-10. Control of practical skills on topics 8-10.

Module 4. Module IV. «Special Histology of regulatory and sensory systems»

Topic 12 Nervous system.

General characteristics of the nervous system. Embryogenesis of the nervous system. Characteristic of the somatic and autonomic parts of nervous systems. Characteristic of the sympathetic and parasympathetic nervous system. Peripheral nervous system. The main tissue elements of the dorsal root ganglion. The spinal cord. Gray and white matter. The structure of the peripheral nerve. Brain and cerebellar cortexes. The concept of associative, projective and commissural fibers. Cytoarchitectonics of the cerebral cortex. Characteristics of the brain stem. Afferent and efferent connections of the cerebellum. Neural composition and layers of the cerebellar cortex.

Topic 13 Sense organs.

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 and vitreous body. The retina and its structural components. Adaptive retinal changes in lighting and in the dark. The structure of the yellow and blind spots of the retina. Optic nerve. Hematoophthalmic barrier. Auxiliary apparatus of the eye. Age changes. General characteristics of the auditory and vestibular organs. Structural elements of the outer , middle ears and their functional significances. The inner ear. The general plan of the structure of cochlea and cochlea canals. The structure of the organ of Corti. The vestibular part of the membranous labyrinth. The structure of the macula of the saccule and the utricle and their functional significance. Histophysiology of the auditory organ. Age-related changes in the auditory organ.

Topic 14 Cardiovascular system.

General morphofunctional characteristics of the cardiovascular system. Embryogenesis of the cardiovascular system. Dependence of the structure of blood and lymphatic vessels on hemodynamic conditions. Morphofunctional characteristics of arteries and their classification. Morphofunctional characteristics of veins and their classification. General characteristics of the lymphatic vessels. Morphofunctional characteristics of blood vessels of the microvasculature. The structure of the main lymphatic trunks. Features of the structural organization of the venous and arterial links of the microvasculature. Arterio-venular anastomoses, general characteristic. General characteristics and structure of the heart. Heart development. The structure and functions of the myocardium. The structure and function of contractile, conductive and secretory cardiomyocytes. Possibilities of myocardial regeneration. Newborn heart. Restructuring, development and age changes hearts.

Topic 15 Organs of hematopoiesis and immune defense.

General characteristics and classification of organs of hematopoiesis and immune defense. Red bone marrow. The interaction of hematopoietic, stromal and vascular components of the red bone marrow. Age-related changes in red bone marrow. Regeneration of the red bone marrow. Yellow bone marrow. General characteristics of the thymus as a central organ of lymphocytopoiesis and immunogenesis. The blood-thymus barrier. 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. General plan of the structure and functional significance of the spleen. The structure, cellular composition and significance of the white pulp and red of the spleen. Blood supply in the spleen. The concept of the immune system. Definition of term “antigens” and “antibody”. Characterization of immunocompetent cells. Cellular immunity. Humoral immunity. Antigen-dependent proliferation and differentiation of lymphocytes. Intercellular interactions in providing immune defense.

Topic 16 Endocrine system.

Morphofunctional characteristic. Classification of the organs of the endocrine system. The concept of hormones, their types, place of action (target cells). Classification of the endocrine glands. The hypothalamus. The structure and function of the neurosecretory cells of the hypothalamus. General characteristics of the pituitary gland. Hypothalamus-adenohypophysis and hypothalamus-neurohypophysis systems, their role. Blood supply connection of the hypothalamus and adenohypophysis. Age-related changes. Epiphysis. Hormones of the pineal gland, their effect. Thyroid gland. The structure of the thyroid gland, tissue and cell composition, structural and functional unit. Phase of production in secretory cycle of thyrocytes. Parafollicular cells, their role. 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. General morphofunctional characteristics of the adrenal glands. The structure 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. The role of adrenal hormones.

Topic 17 The test control of the Module IV «Special Histology of regulatory and sensory systems».

The test and theoretical control of topics 12-16. Control of practical skills on topics 12-16.

Module 5. Module V. «Special Histology and Embryology of internal organs»

Topic 18 Digestive system.

General morphofunctional characteristics of digestive system. Classification of internal organs: tubular and parenchymal. Digestive channel. General plan of structure of wall. Innervation and vascularisation. Sources of digestive tube development. Oral cavity. Features of structure of different organs in oral cavity. Teeth. General plan of structure. Types of teeth. Tooth tissue: enamel, dentin, cement. Development of baby and permanent teeth. The clinical significance of violations of the early stages of tooth development. Histogenesis of tooth tissues. The structure and significance of the pulp. Morphological characteristics of esophagus and pharynx. Morphological characteristics of the wall of the esophagus in different parts. General morphological and functional characteristics of the stomach. Characterization of the gastric glands. General characteristics and functions of the small and large intestine. Histophysiology of the crypt-villus system. Features of structure of the duodenum. The microscopic and ultramicroscopic structure of exocrine and endocrine parts of the pancreas. Hormones and their significance. General characteristics and functions of the liver. Liver development. Features of blood supply to the liver. Morphological characteristics of the gallbladder and biliary tract. Age-related changes in liver.

Topic 19 Respiratory system.

Morphofunctional characteristics. Respirator and unrespirator functions, respiratory ways. Sources of development. General plan of structure of wall of respiratory ways. Characterization of the membranes of respiratory ways. Characteristics of respiratory epithelial cells (ciliated cells, goblet, basal, high plug-in, Clara cells, endocrinocytes, dendritic cells). The concept of broncho-associated lymphoid tissue, its significance for the body. The sense of smell. General characteristics. Embryogenesis. Localization. Characterization of the olfactory region. Histophysiology of the organ of smell. 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. Age - dependent changes.

Topic 20 Skin. Derivatives skin. Skin functions and its significance. The tissue composition of the skin. Regeneration. Epidermis. Its layers, features of the structure of "thick" and "thin" skin. Keratinocytes. Processes keratinization in the epidermis. Tactile epitheliocytes. Dermis. Papillary and reticular layers. Features of the structure of the dermis in different areas of the skin. 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 21 Urinary system. General plan of organization of the urinary system. Embryogenesis. Sources and basic stages of development. Age - dependent changes. Kidney. The general plan of the structure. Endocrine apparatus of the kidney. General characteristics of nephrons. Features of blood supply of the kidneys. Features of blood supply of the juxtamedular nephrons. Characterization of the mucous membrane of the urinary tract. The structure of the muscular and external membranes of the urinary organs. Bladder. Age-related changes in bladder.
Topic 22 Reproductive system. The general plan of the structure of the male reproductive system. Embryogenesis of the male reproductive system. Testis. Structure. Embryonic and post-embryonic histogenesis. Functions. Spermatogenesis. Concept of a hematotesticular barrier. Variants and anomalies of development of male genitals. Female reproductive organs. Ovaries. Ovogenesis. Changes during the ovarian-menstrual cycle, their hormonal regulation. The value of atretic follicles for the functioning of the female reproductive system. Oviducts and vagina. The mammary gland. Development, structure and functions. Hormonal regulation of the mammary gland.
Topic 23 The test control of the Module V «Special Histology and Embryology of internal organs». The test and theoretical control of topics 18-22. Control of practical skills on topics 18-22.

5. Intended learning outcomes of the course

After successful study of the course, the student will be able to:

LO1	Be able to use light microscopy. Know the methodology of histology technique.
LO2	Be able to use the acquired knowledge, skills, abilities on histological examination of different types of tissues and understanding of the structural and functional elements.
LO3	The ability to apply knowledge of the structures of organs and systems of the human body in the practice of a doctor, scientific and teaching activities.
LO4	The ability to determine types of cell, stages of embryo development, tissue types, structure of different organs of the human body.
LO5	Use information technology, acquired knowledge, skills and abilities to solve various issues and problems in the medicine, teamwork skills.
LO6	Use the acquired knowledge for further study of physiology, pathological anatomy and pathological physiology by students, which involves the integration of teaching with these disciplines and the formation of skills to apply knowledge of histology, cytology and embryology in further study and professional activities.

LO7	Be able to think abstractly about the structure and function of organs, systems and the human body as a whole, synthesize information, draw reasoned conclusions, the ability to learn.

6. Role of the course in the achievement of programme learning outcomes

Programme learning outcomes achieved by the course.
For 222 Medicine:

PO1	To detect and identify the leading clinical symptoms and syndromes (according to the List 1); to establish the most probable nosological or syndromic preliminary clinical diagnosis of diseases (according to the List 2) using standard methods, preliminary data of the patient's anamnesis, patient's examination data, and knowledge about a human, his organs and systems.
PO2	To collect information about the patient's general condition; to assess the patient's psychomotor and physical development and the state of organs and systems of the body; to assess information on the diagnosis (according to the List 4) based on laboratory and instrumental findings.
PO3	To order and analyze additional (mandatory and optional) examinations (laboratory, radiological, functional and/or instrumental) (according to the List 4) in order to perform a differential diagnosis of diseases (according to the List 2).
PO4	To establish a final clinical diagnosis at a medical institution under control of a supervising doctor by means of informed decision and logical analysis of the obtained subjective and objective data of clinical and additional examinations, and differential diagnosis, following the relevant ethical and legal norms (according to the List 2).
PO9	To determine an appropriate approach, plan, and management of physiological pregnancy, physiological delivery, and postpartum period by making a reasonable decision according to existing algorithms and standard procedures.
PO18	To search for the necessary information in the professional literature and databases; to analyze, evaluate, and apply this information. To apply modern digital technologies, specialized software, statistical methods of data analysis to solve complex health problems.

7. Teaching and learning activities

7.1 Types of training

Topic 1. History of development histology, cytology and embryology. Histological technique. The aim and tasks of cytology.

pr.tr.1 "History of development histology, cytology and embryology. Histological technique. The aim and tasks of cytology." (full-time course)

The emergence of histology, cytology and embryology as separate sciences. The value of the research of R. Hooke, A. Levenguk, J. Purkinje, R. Brown, M. Schleiden, T. Schwann for the creation of cell theory. Cell theory is both the basis of biology and the basis for the development of embryology, histology, physiology. Systematization of information about the microscopic organization and development of cells, tissues, organs. The current state of development of histology, cytology and embryology, its achievements, problems, prospects. Relationship of histology with other sciences of medical and biological profile. Microscopic research methods in histology are as basic. Principles of manufacturing drugs for light and electron microscopy: obtaining material, fixation, dehydration, processing, embedding, sectioning on microtome and ultramicrotome. Types of histology specimens. The concept of different staining. Microscopy technique, the concept of resolution. Special methods of light microscopy. Transmission and scanning electron microscopy. The concept of histochemical, immunocytochemical and radioautographic metods. Vital research methods. Acquaintance with the scientific laboratories of the department and the principles of their work. Watching scientific films with their further discussion. Computer testing in a computer class.

Topic 2. The structure of the cell.

pr.tr.2 "General morphology of the cell. Plasmalemma. Noncellular structure of organism." (full-time course)

The concept of the cell as an elementary living system. General morphology of the eukaryotic cell. Modern idea of the elementary biological membrane as the basis of the receptor-barrier-transport system of the cell (plasmolemma). 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-desmosos. The study of this topic involves theoretical and practical work in the class room, the study of histology specimen: "The general structure of the cell. Symplast (skeletal muscles). Intercellular substance (elastic cartilage)" using light microscopes and electronograms. Demonstration of histology specimen is carried out with the help of multimedia. Computer testing in a computer class.

pr.tr.3 "Cytoplasm of the cell: hialoplasma, organelles of the general importance." (full-time course)

Main components of the cytoplasm - hyaloplasm, organelles, inclusions. Hyaloplasm - definition. Cytosol and cytomatrix, physicochemical properties, chemical composition, role in cellular metabolism. Organelles – definition, classification. Organelles of the general importance (endoplasmic reticulum, golgi complex, lysosome, peroxisomes, mitochondria). Nonmembranous organelles (ribosomes, centrosome).The study of this topic involves theoretical and practical work in the class room, the study of histology specimen (Golgi complex in nerve cells, mitochondria in kidney cells) using light microscopes and electronograms. Computer testing in a computer class.

pr.tr.4 "Cytoplasm of the cell: organelles of special importance. Inclusion." (full-time course)

Organelles of the special importance. (microfilaments, microtubules, cilia and flagella). Cytoskeleton, structure and functional. Inclusion of cytoplasm, their classification and value. The study of this topic involves theoretical and practical work in the class room, the study of histology specimen (inclusion of glycogen, pigment inclusions, fatty inclusions, ciliated epithelium) using light microscopes and electronograms. Demonstration of histology specimen is carried out with the help of a multimedia installation. Computer testing in a computer class.

pr.tr.5 "Cell nucleus." (full-time course)

The value of the nucleus in the life of a eukaryotic cell. Shape, size, number of nuclei and nuclear-cytoplasmic ratio in different types of cells. The main components of the nucleus: nuclear envelope, chromatin, nucleolus, nuclear matrix. Nuclear envelope, its structural and functional organization: membranes, perinuclear sinternal space, nuclear pores. Chromatin, chemical composition. Chromatin as an interphase state of chromosomes, sex chromatin. The concept of euchromatin and heterochromatin. Levels of chromatin packing. Structure and function of chromosomes and cell division. Karyotype. The nucleolus, as a derivative of chromosomes. The structure of the nucleolus and its role in chromosome formation. The study of this topic involves theoretical and practical work in the class room, the study of histology specimen (a cell with a round nucleus, a cell with an elongated nucleus, a segmental nucleus neitrophil) using light microscopes and electronograms. Demonstration of histology specimen is carried out with the help of a multimedia installation. Computer testing in a computer class.

Topic 3. Cell reproduction. Aging and death of the cell.

pr.tr.6 "Cells division. Cell cycle. Aging and death of cell." (full-time course)

The cell cycle and its periods. Types of cells that exit 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. Adaptation of cells, its importance for preserving the life of cells in altered living conditions. Watch movies showing the cell cycle, types of aging, and cell death. The study of this topic involves theoretical and practical work in the class room, the study of histology specimen (mitosis and amitosis) using light microscopes and electronograms. Demonstration of histology specimen is carried out with the help of a multimedia installation. Computer testing in a computer class.

Topic 4. The test control of the Module I «Cytology».

pr.tr.7 "The test control of the Module I «Cytology»." (full-time course)

The test and theoretical control of topics 1-3.

pr.tr.8 "The test control of the Module I «Cytology»." (full-time course)

Control of practical skills on topics 1-3.

Topic 5. Bases of general embryology.

lect.1 "Lk1 "Introduction to embryology, basic concepts."" (full-time course)

Theories of embryology: preformism, epigenesis. The main processes of embryogenesis. Sex cells, features of the structure of human sex cells. Stages of insemination (distance and contact phases). Formation of zygot. Characteristics of splitting. Formation of morula, the formation of blastula. Types of blastula in one-time chord animals. Gastrusion. Methods of gastriation. Early and late stages of gastriation in humans. Formation, structure and significance of the provisoric organs (amion, chorion, allantios, yolk sac). Placenta. Teaching is carried out in the form of multimedia interactive lectures (in the presence of quarantine - in the online mode). Computer testing in a computer class.

pr.tr.9 "Bases of general embryology. Germ cells. Fertilization." (full-time course)

The aim and tasks of embryology, significance for medicine. Research methods. History of embryology. Theories of embryogenesis: preformism, epigenesis, neopreformism. The main stages of embryo development. The concept of biological processes underlying the development of the embryo: induction, determination, division, cell migration, growth, differentiation, cell interaction. Germ cells. Types of oocytes. Fertilization, phases, its biological significance.Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of histology specimens (ovum, spermatos, syncarion) using light microscopes. Demonstration of histology specimen is carried out with the help of a multimedia installation. Computer testing in a computer class.

pr.tr.10 "Cleavage. Implantation." (full-time course)

Zygote as a unicellular organism. Cleavage, its definition. Methods of cleavage in different classes of vertebrates. Cleavage of the human embryo, chronology of the process. Types of blastulas. Morula. The formation of blastocysts and derivatives of tropho- and embryoblast. General characteristics of the implantation process. Characterization of implantation phases. Studying the topic involves theoretical and practical work in the class room, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of histology specimens (cleavage, amphiblastula) using light microscopes. Demonstration of histology specimen is carried out with the help of a multimedia installation. Computer testing in a computer class.

pr.tr.11 "Gastrulation. Histo- and organogenesis." (full-time course)

Gastrulation, its definition. Methods of the first phase of gastrulation in different classes of vertebrates. Features of gastrulation in humans. Demonstration of films with further discussion (structures formed as a result of the first phase of gastrulation, epiblast and hypoblast, presumption at the stage of formation of the primary strip, the second phase of gastrusion in humans, formation of germ mesoderma, neuralization and formation of the axial complex of organs, differentiation of germ leaves and their derivatives. The study of this topic involves theoretical and practical work in the class room, the study of histology specimens (primary strip, the formation of axial conceptions of organs, the late stage of gastriation) using light microscopes. Demonstration of histology specimen is carried out with the help of a multimedia installation. Computer testing in a computer class.

Topic 6. Extraembryonic (provisional) organs.

pr.tr.12 "Provisional organs." (full-time course)

Provisional organs in different classes of vertebrates. Provisional organs in humans: chorion, amnion, yolk sac, allantois. Their structure and significance. Demonstration of the scientific film with further discussion: Human provisor organs: chorion (formation and structure of primary, secondary and final villi), ammonium, yolk sac, allantois, umbilical cord. Their structure and meaning. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of histology specimens (ammonium, allentois, chorion villi) using light microscopes. Demonstration of drugs is carried out with the help of a multimedia installation. Computer testing in a computer class.

pr.tr.13 "Placenta, critical periods of human development." (full-time course)

Types of placentas in different classes of vertebrates, their structure. Demonstration of the scientific film with further discussion: Human placenta (fetal part, maternal part), its development, structure and functions. Changes in the endometrium during pregnancy, fetal membranes. Mother-fruit system. Concept of critical periods of embryogenesis and ontogenesis. The concept of in vitro fertilization, its medical and social significance. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of histology specimens (maternal part of the placenta, the fetal part of the placenta, umbilical cord) using light microscopes. Demonstration of histology specimen is carried out with the help of a multimedia installation. Computer testing in a computer class.

Topic 7. The test control of the Module II «Basic and comparative Embryology».

pr.tr.14 "The test control of the Module II «Basic and comparative Embryology»." (full-time course)

The test and theoretical control of topics 5-6.

pr.tr.15 "The test control of the Module II «Basic and comparative Embryology»." (full-time course)

Control of practical skills on topics 5-6.

Topic 8. Basic principles of organization of tissues. Epithelium tissues.

lect.2 "Lk2 "Introduction to the doctrine of fabrics. General principles of tissue organization. Epithelial tissues."" (full-time course)

The concept of fabrics. Basic principles of organization and classification of fabrics. Formation of tissues on the basis of differentiation of embryonic conception cells. Determination and differentiation of cells, their molecular genetic basis. Histogenetic series. Types of physiological regeneration. Concept of reparative regeneration and metaplasia. Epithelial tissues. Organization of epithelial layer. Genetic and morphofunctional classification of epithelial tissues. General characteristics of epithelial tissue (topography, basic morphofunctional features, function and sources of development). The structure of the glandular epithelium. Types of glandular secretion.Teaching is carried out in the form of multimedia interactive lectures (in the presence of quarantine - in the online mode).

pr.tr.16 "Basic knowledge of tissues. Simple epithelium." (full-time course)

The concept of fabrics. Basic principles of organization and classification of fabrics. Formation of tissues on the basis of differentiation of embryonic conception cells. Determination and differentiation of cells, their molecular genetic basis. Histogenetic series (differentons). Types of physiological regeneration. Concept of reparative regeneration and metaplasia. Epithelial tissues. General morphofunctional characteristics of the epithelium. Organization of epithelial layer. Cytokeratons as markers of different types of epithelial tissues. Modern ideas about the structure, origin and function of the basal membrane. Epithelium nutrition. Genetic and morphofunctional classification of epithelial tissues. Characteristics of the single-layer epithelium. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies) method of demonstrations with further discussion; study of histology specimens (simple squamous epithelium, simple cubic epithelium, simple columnar) using light microscopes. Demonstration of histology specimen is carried out with the help of a multimedia installation. Computer testing in a computer class.

pr.tr.17 "Stratified and glandular epithelium." (full-time course)

Structural and functional organization of various types of multilayer epithelium (multilayer flat-wired, multilayer flat unroxable, transitional). Features of physiological and reparative regeneration of epithelial tissues. Glandular epithelium. Structure and classification of glands (endocrine and exocrine). Secretory cycle. Types of secretion (merocrine, apocrine, holocrine). The study of this topic involves theoretical and practical work in the class room, the study of histology specimens (stratified squamous keratinized epithelium, stratified squamous non-keratinized epithelium, transitional epithelium, apocrine type of secretion) using light microscopes and electronograms. Demonstration of histology specimen is carried out with the help of a multimedia installation. Computer testing in a computer class.

Topic 9. Internal environment tissues.

lect.3 "Lk3 " Internal environment tissues. Blood and lymph. Connective tissues."" (full-time course)

Common morphofunctional signs of tissues of the internal environment. Origin. Classification of tissues of the internal environment. Blood as a tissue, its components, functions. Blood plasma, its composition and meaning. Molded blood elements, their functional morphology, quantitative characteristics. Hemogram and leukocytic formula, their features in newborns and children of all ages. Loose connective tissue (LCT), localization, components, functions. Cellular composition of (LCT), their origin and functional morphology. Intercellular substance (LCT), structural, functional and molecular organization of amorphous and fierous components. Dense connective tissues, their varieties - irregular and regular. Localization, structure and functions. Teaching is carried out in the form of multimedia interactive lectures (in the presence of quarantine - in the online mode).

pr.tr.18 "Connective tissue. Blood and lymph." (full-time course)

Common morphofunctional signs of tissues of the internal environment. Origin. Classification of tissues of the internal environment. Blood as a tissue, its components, functions. Blood plasma, its composition and meaning. Molded blood elements, their functional morphology, quantitative characteristics. Hemogram and leukocytic formula, their features in newborns and children of all ages. Lymph, main functions, composition. The study of this topic involves theoretical and practical work in the class room, consideration of situational problems, study of histology specimens (human blood, frog blood) using light microscopes and electronograms. Demonstration of histology specimen is carried out with the help of a multimedia installation. Computer testing in a computer class.

pr.tr.19 "Hematopoiesis." (full-time course)

Hemopoiesis and lymphopoiesis. Postnatal hemopoiesis as physiological regeneration of blood. Myeloid and lymphoid tissue. Modern theory of hematopoiesis. Stem hematopoietic cell, its properties. Stem hematopoietic cell, its properties. Semi-stem cells. The concept of colony-forming units. Precursor cells, maturing and mature blood forms. Demonstration of the scientific film with further discussion: Histogenetic series: erythropoiesis, granulocytosis, monocytopoesis, lymphoposis. Embryonal hemopoiesis (development of blood as tissue), its stages. The study of this topic involves theoretical and practical work in the class room, the study of histology specimens (red bone marrow) using light microscopes. Demonstration of histology specimen is carried out with the help of a multimedia installation. Computer testing in a computer class.

pr.tr.20 "Connective tissue. Loose connective tissue." (full-time course)

Loose connective tissue (LCT), localization, components, functions. Cellular composition of (LCT), their origin and functional morphology. Intercellular substance (LCT), structural, functional and molecular organization of amorphous and fibers components. The study of this topic involves theoretical work in the class room, consideration of situational problems, the study of histology specimens (loose fibre connective tissue) using light microscopes and electronograms. Demonstration of histology specimen is carried out with the help of a multimedia installation. Computer testing in a computer class.

pr.tr.21 "Dense connective tissue. Connective tissue with special properties." (full-time course)

Dense connective tissues, their varieties - irregular and regular. Localization, structure and functions. The structure of the tendon. Characterization of connective tissue with special properties (reticular, adipose (white, brown), mucous, pigment), localization, components, functions. Studying the topic involves theoretical and practical work in the class room, the use of virtual simulation (watching movies), method of demonstrations with further discussion; study of histology specimens (tendons in the transverse section, tendons in the longitudinal section, pigment tissue, reticular tissue, adipose tissue) using light microscopes and electrongrams. Demonstration of histology specimen is carried out with the help of a multimedia installation. Computer testing in a computer class.

pr.tr.22 "Cartilagenous tissue." (full-time course)

General plan of structure and function. Cellular elements (chondrobrasti, chondrocytes), isogenic groups of cells. Intercellular substance of cartilage tissue, structural-functional and molecular organization of amorphous and fierminous components. Cartilage as an organ. Types of cartilage: hyaline, elastic and fibro. Regeneration and age-related changes in cartilage tissue. Histogenesis of cartilage tissue. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), method of demonstrations with further discussion; consideration of situational problems, study of histology specimens (hyaline cartilage, elastic cartilage, fibrocartilage) using light microscopes and electronograms. Demonstration of histology specimen is carried out with the help of a multimedia installation. Computer testing in a computer class.

pr.tr.23 "Structure of osseous tissue." (full-time course)

General plan of structure and function. Varieties of bone cells: osteoblasts, osteocytes, osteoclasts. Intercellular substance, its composition (fiber and amorphous component). Types of bone tissue. Bone as an organ. Perseverance, its role in the structure, nourishing, fasting and regeneration of bone. Osteon is a structural and functional unit of plate bone tissue. The study of this topic involves theoretical and practical work in the class room, consideration of situational problems, the study of (bone in the transverse, bone in the longitudinal section) using light microscopes and electronograms. Demonstration of histology specimen is carried out with the help of a multimedia installation. Computer testing in a computer class.

pr.tr.24 "Histogenesis, regeneration and aging changes of osseous tissues." (full-time course)

Histogenesis of bone tissue. Demonstration of the scientific film with further discussion: intramembranous and endochondral ossification, bone remodeling in the body. Factors affecting bone growth. Bone connection. Classification. Studying the topic involves theoretical and practical work in the class room, the use of virtual simulation (watching movies), method of demonstrations with further discussion; study of histology specimens (intramembranous and endochondral ossification) using light microscopes. Demonstration of histology specimen is carried out with the help of a multimedia installation. Computer testing in a computer class.

Topic 10. Specialized connective tissue. Muscles tissues. Nervous tissue.

lect.4 "Muscles tissues." (full-time course)

General morphofunctional characteristics of muscle tissue, genetic and morphological classification. Histogenesis, structure, morphofic and histochemical characteristics of skeletal and smooth muscles. Morphological bases of contraction of skeletal and doddy muscles. Regeneration of muscle tissue. Teaching is carried out in the form of multimedia interactive lectures (in the presence of quarantine - in the online mode).

lect.5 "Nervous tissue. Nervous system." (full-time course)

General morphofic characteristics of nerve tissue. Histogenesis. Neurons, general structure plan, morphological and functional classification. The concept of neurotransmitters. The structure of the synapse. Neuroglia. General characteristics, main varieties. Nerve fibers, varieties (myelin and unmyelin), their microscopic and ultramicroscopic structure. Nerve endings. Peripheral nervous system. Sensitive nerve nodes (spinal cord and cranial). Sources of development. Fabric composition. Spinal cord. General morphofunctional characteristic. Central nervous system. Gray and white matter. Brain. The concept of cyto-and myeloarchitectonic of the cerebral cortex. Cerebellum. Structure and functions. Teaching is carried out in the form of multimedia interactive lectures (in the presence of quarantine - in the online mode). Computer testing in a computer class.

pr.tr.25 "Transverse-striated skeletal muscle tissue." (full-time course)

General morphofunctional characteristics of muscle tissue, genetic and morphological classification. Smug muscle tissue (somatic type). Localization, histogenesis, functional features. Muscular fiber as a structural and functional unit, microscopic, ultrastructural (structure of actin and myosin), molecular organization. Morphological bases of contraction of skeletal muscles. Types of muscle fibers. Muscle as an organ. Endomysium, perimysium, epimysium. Regeneration of skeletal muscle tissue. Studying the topic involves theoretical and practical work in the study room, the use of virtual simulation (watching movies), method of demonstrations with further discussion; consideration of situational problems, study of histology specimen (skeletal muscles in the transverse section, skeletal muscles in the longitudinal section) using light microscopes and electronograms. Demonstration of histology specimen is carried out with the help of a multimedia installation. Computer testing in a computer class.

pr.tr.26 "Smoothe muscle tissue." (full-time course)

Smooth muscle tissue of mesenchym origin. Histogenesis, structure, morphofunctional and histochemical characteristics. Myocyte. Organization of shrinking apparatus. Regeneration of smooth muscle tissue. Unstressed muscle tissues of epidermal and neiral origin. The study of this topic involves theoretical and practical work in the class room, the study of histology specimen (smooth muscles in the transverse, smooth muscles in the longitudinal section) using light microscopes and electronograms.

pr.tr.27 "Nervous tissue. Neurons. Neuroglia." (full-time course)

General morphofunctional characteristic. Histogenesis. Neurons, general structure plan, morphological and functional classification. Cytophysiology of neuron: pericarione, dendrites and axon, axon transport (anterograde and retrograde). The concept of neurotransmitters. Secretory neurons. Neuroglia. General characteristics, main varieties. Macroglia (epentomacytes, astrocytes, oligodendrocytes). Microglia. Studying the topic involves theoretical and practical work in the study room, the use of virtual simulation (watching movies), method of demonstrations with further discussion; consideration of situational problems, study of histology specimen (neurofibril in nerve cells, Nisl substance) using light microscopes and electronograms. Demonstration of histology specimen is carried out with the help of a multimedia installation. Computer testing in a computer class.

pr.tr.28 "Nerve fibers and nerve endings." (full-time course)

Nerve fibers, varieties (myelin and non-myelin), their microscopic and ultramicroscopic structure. Regeneration of nerve tissue. Nerve endings. General morphofunctional characteristic. Receptors and effectors, their classification and structure. The concept of synapse. Interneuron synapses (classification, structure, mediators). Mechanism of excitation transmission in synapses. Morphological substract of the reflex activity of the nervous system (the concept of simple and complex reflex arcs). Neural theory. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; consideration of situational problems, study of histology specimen (myelin nerve fibers, non-myelin nerve fibers) using light microscopes and electronograms. Demonstration of histology specimen is carried out with the help of a multimedia installation. Computer testing in a computer class.

pr.tr.29 "Autonomic nervous system." (full-time course)

Somatic and autonomic (autonomic) nervous system. The concept of a metasymptotic nervous system. Demonstration of the scientific film with further discussion: parasympic and sympathetic departments of the autonomous nervous system. Nucleus of the central parts of the autonomic nervous system. The structure of the ganglia vegetative nervous system. The structure of nerve trunks. Features of their reaction to damage, recovery processes. The study of this topic involves theoretical and practical work in the class room, consideration of situational problems, study of histology specimen (vegetative nervous ganglium) using light microscopes. Demonstration of histology specimen is carried out with the help of a multimedia installation

Topic 11. The test control of the Module III «General Histology».

pr.tr.30 "The test control of the Module III «General Histology»." (full-time course)

The test and theoretical control of topics 8-10

pr.tr.31 "The test control of the Module III «General Histology»." (full-time course)

Control of practical skills on topics 8-10.

pr.tr.32 "Module control of the first semester." (full-time course)

Module control of the first semester.

Topic 12. Nervous system.

pr.tr.33 "Central nervous system. Brain. Cerebellum." (full-time course)

Central nervous system. Gray and white matter. Nerve centers. Brain shells. Brain. On-screen type of the structure of the centers of the cerebral cortex. The concept of cyto-and myeloarchitectonic of the cerebral cortex. The concept of the modular principle of organizing the cerebral cortex. Interneuronic relationships. Gliocytes. Hematoencephalic barrier, structure, value. Brain stem. The most important associative nucleus. Reticular formation. Intermediate brain. Thalamus nuclei. Hypothalamus, the main nucleus. Functions of the intermediate brain. Cerebellum. Interneuronic relationships. Esferent and aferent fibers. The study of this topic involves theoretical work in the class room, consideration of situational problems, the study of histology specimen (cerebral cortex, cerebellum cortex) with the use of light microscopes and electronograms. Demonstration of histology specimen is carried out with the help of a multimedia installation. Computer testing in a computer class.

pr.tr.34 "Peripheral nervous system." (full-time course)

General morphofunctional characteristic. Embryogenesis. Classification (anatomical and physiological). Peripheral nervous system. Sensitive nerve nodes (spinal cord and cranial). Sources of development. The position of the nodes in the reflector arcs. Spinal cord. General morphofunctional characteristic. The structure of gray matter. Neural composition of the cores of the spinal cord, own apparatus of the spinal cord. White matter. Leading ways. The study of this topic involves theoretical and practical work in the class room, consideration of situational problems, the study of histology specimen (dorsal root ganglion, nerve trunk, spinal cord) with the use of light microscopes and electronograms. Demonstration of histology specimen is carried out with the help of a multimedia installation. Computer testing in a computer class.

Topic 13. Sense organs.

pr.tr.35 "Sense organs. Vision organ (front section)." (full-time course)

General characteristics of the senses. The doctrine of touch systems. Classification of the senses by the structure and origin of the receptor cells. A demonstration of a scientific film with further discussion: The organ of vision. General characteristics. Embryogenesis. The general plan of the structure of the eyeball. Tunics, their sections and derivatives. The main functional apparatuses: dioptric, accomidation, receptor. The structure of the protein tunics (sclera and cornea). Structure of the cardiovascular tunics (choroid, ciliary body, iris). Chambers of the eyeball: the front, back, their walls. Vitrrous body, lens. Accomdation apparatus of the eye. The study of this topic involves theoretical and practical work in the class room, consideration of situational problems, the study of histology specimen (cornea of the eye) using light microscopes and electronograms. Demonstration of histology specimen is carried out with the help of a multimedia installation. Computer testing in a computer class.

pr.tr.36 "Sensory organs. Auditory organ." (full-time course)

General characteristics of the auditory organ. External, middle (auditory ossicles, auditory tube) and inner ear. A demonstration of the science film followed by discussion: Bone and weed mazes. Modiolus (auditory) part of the fluid-filled membranous labyrinths (cochlear duct). The structure of the spiral organ of Corti. Hair and supporting cells. Histophysiology of the organ of hearing. Embryogenesis of the organ of hearing. Age-related changes. The study of this topic involves theoretical and practical work in the class room, consideration of situational problems, the study of histology specimens (modiolus, cochlear duct, spiral organ of Corti) using light microscopes. Demonstration of histology specimen is carried out with the help of a multimedia installation. Computer testing in a computer class

pr.tr.37 "Sensory organs. Equilibrium organ." (full-time course)

General morphofunctional characteristics of the equilibrium organ. The structure of the bone and fluid-filled membranous labyrinths of the equilibrium organ. Vestibular part fluid-filled membranous labyrinths: the utericule, the saccule and the crista ampoullaris. The structure of hair and supporting cells. Otolithic membrane and cupula. Histophysiology of the vesibular apparatus. Embryogenesis of the equilibrium organ. Age-related changes. The study of this topic involves theoretical and practical work in the class room, consideration of situational problems, the study of histology specimens (equilibrium organ) using light microscopes. Demonstration of histology specimen is carried out with the help of a multimedia installation. Computer testing in a computer class.

pr.tr.38 "Sense organs. Vision organ (retina)." (full-time course)

Neural composition of the retina. Photoreceptor cells, their microscopic, ultramicroscopic and cytochemical features. Retinal neuroglia. The structure of the yellow and blind spots of the retina. Optic nerve. Accessory apparatus of the eye. Age-related changes. The study of this topic involves theoretical and practical work in the class room, consideration of situational problems, the study of histology specimen (neural composition of the retina) using light microscopes. Demonstration of histology specimen is carried out with the help of a multimedia installation. Computer testing in a computer class.

Topic 14. Cardiovascular system.

lect.6 "Cardiovascular system." (full-time course)

General morphofunctional characteristics of the cardiovascular system. Embryogenesis of the vascular system. Dependence of the structure of blood and lymph vessels on hemodynamic conditions. Arteries, their classification. The structure of arteries of different types. Veins. Features of the structure in comparison with the arteries. Classification of veins. Function of the capillaries. The structure of the main lymphatic trunks. Features of the structural organization of the venous and arterial links of the microvasculature. Arterio-venular anastomoses, general characteristic. General characteristics and structure of the heart. Endocardium, heart valves. Myocardial. Features of the structure and function of heart muscle tissue. Morphofunctional characteristic of contractile, conductive and secretory cardiomyocytes. Teaching is carried out in the form of multimedia interactive lectures (in the presence of quarantine - in the online

pr.tr.39 "Cardiovascular system. Arteries. Veins." (full-time course)

General morphofunctional characteristics of the cardiovascular system. Embryogenesis of the cardiovascular system. Dependence of the structure of blood and lymph vessels on hemodynamic conditions. Arteries, their classification. The structure of the arteries of elastic, muscular and mixed types. General morphofunctional characteristics of the cardiovascular system. Embryogenesis of the vascular system. Dependence of the structure of blood and lymph vessels on hemodynamic conditions. Arteries, their classification. The structure of the arteries of elastic, muscular and mixed types. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of histology specimens (elastic artery, muscular artery, vein) using light microscopes.

pr.tr.40 "Cardiovascular system. Blood vessels of the microvasculature." (full-time course)

Hemomicrocirculator channel, its components. Capillaries, their microscopic and ultramicroscopic structure. Classification of capillaries in the structure of endotelia and basal membrane. Function of the capillaries. The structure of the main lymphatic trunks. Features of the structural organization of the venous and arterial links of the microvasculature. Arterio-venular anastomoses, general characteristic. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of histology specimens (arterioles, veinules and capillaries) using light microscopes and electronograms. Demonstration of histology specimen is carried out with the help of a multimedia installation. In addition, studying the topic, it is envisaged to solve a practice-indicative task. Computer testing in a computer class.

pr.tr.41 "Cardiovascular system. Heart." (full-time course)

Heart development in human embryogenesis. The general structure of the heart wall. Endocardium, heart valves. Myocardium. Features of the structure and function of heart muscle tissue. Morphofunctional characteristic of contractile, conductive and secretory cardiomyocytes. The structure of the epicardium and pericardium. Possibilities of myocardial regeneration. Newborn heart. Restructuring, development and age changes hearts. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of histology specimens (myocardium, Purkinje fibers) using light microscopes and electronograms. Demonstration of histology specimen is carried out with the help of a multimedia installation. In addition, studying the topic, it is envisaged to solve a practice-indicative task. Computer testing in a computer class.

Topic 15. Organs of hematopoiesis and immune defense.

lect.7 "Organs of hematopoiesis and immune defense." (full-time course)

General characteristics and functional significance of the lymph nodes. The cortex of the lymph nodes. Medulla and paracortical zone. General plan of the structure and functional significance of the spleen. The structure, cellular composition and significance of the white pulp and red of the spleen. Blood supply in the spleen. Characteristics of cells involved in immune reactions. Teaching is carried out in the form of multimedia interactive lectures (in the presence of quarantine - in the online mode).

pr.tr.42 "Organs of hematopoiesis and immune defense. Spleen. Lymph nodes." (full-time course)

General characteristics and functional significance of the lymph nodes. The cortex of the lymph nodes. Medulla and paracortical zone. General plan of the structure and functional significance of the spleen. The structure, cellular composition and significance of the white pulp and red of the spleen. Blood supply in the spleen. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of histology specimens (lymph nodes, spleen) using light microscopes and electronograms. Demonstration of histology specimen is carried out with the help of a multimedia installation. In addition, studying the topic, it is envisaged to solve a practice-indicative task. Computer testing in a computer class.

pr.tr.42 "Organs of hematopoiesis and immune defense. Bone marrow. Thymus" (full-time course)

General characteristics and classification of organs of hematopoiesis and immune defense. Red bone marrow. The interaction of hematopoietic, stromal and vascular components of the red bone marrow. Age-related changes in red bone marrow. Regeneration of the red bone marrow. Yellow bone marrow. General characteristics of the thymus as a central organ of lymphocytopoiesis and immunogenesis. The blood-thymus barrier. Development and age-related changes in the thymus. Accidental involution of the thymus and its regeneration. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of histology specimens (red bone marro, thymus) using light microscopes and electronograms. Demonstration of histology specimen is carried out with the help of a multimedia installation. In addition, studying the topic, it is envisaged to solve a practice-indicative task. Computer testing in a computer class.

pr.tr.44 "Cellular immunity response." (full-time course)

The concept of the immune system. Definition of term “antigens” and “antibody”. Characterization of immunocompetent cells. Characteristics of the major histocompatibility complex (MHC-I, MHC-II). Types of T-lymphocytes and their meanings (T-killers, T-gelpers, T-supressors, T-memory). CD nomenclature of T-lymphocytes. Characteristics of cells involved in immune reactions (macrophagy, T-lymphocytes, B-lymphocytes, plasmocytes, antigen-resinting cells of the agro-industrial complex). The demonstration of films is carried out using a multimedia installation and TV. In addition, studying the topic, it is envisaged to solve a practice-indicative task. Computer testing in a computer class.

pr.tr.45 "Cellular immunity responce. Seminar." (full-time course)

Cellular immunity. Humoral immunity. Antigen-dependent proliferation and differentiation of lymphocytes. Intercellular interactions in providing immune defense. The study of the topic involves theoretical work in the classroom with the use of the method of demonstrations of students' presentation works with their subsequent discussion. Presentations are presented using a multimedia installation and a TV. When studying the topic, it is envisaged to solve a practice-indicative task.

Topic 16. Endocrine system.

lect.8 "Endocrine system." (full-time course)

General morphofunctional characteristic. The concept of hormones and their importance to the body. Central organs of the endocrine system: hypothalamus, pituitary gland, epiphysis. Structure, cellular composition, hormones and their functions. Peripheral organs of endocrine systems: thyroid, parathyroid glands, adrenal glands. Development, structure, cellular composition, hormones and their functions. Single hormone-producer cells (dislocated endocrine system). Cells of the APUD- system, localization, hormones and their action. Teaching is carried out in the form of multimedia interactive lectures (in the presence of quarantine - in the online mode).

pr.tr.46 "Central endocrine organs. Hypothalamus. Epiphysis." (full-time course)

General morphofunctional characteristic. The concept of hormones and their importance to the body. Target cells and hormone receptors. Mechanism of action of hormones. The principle of feedback. Classification of endocrine glands. Central and peripheral links of the endocrine system. Neuroendocrine system of regulation of body functions. The hypothalamus. The structure and function of the neurosecretory cells of the hypothalamus. General characteristics of the pituitary gland. Hypothalamus-adenohypophysis and hypothalamus-neurohypophysis systems, their role. Blood supply connection of the hypothalamus and adenohypophysis. Age-related changes. Epiphysis. Hormones of the pineal gland, their effect. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of histology specimen (pituitary gland) using light microscopes and electronograms. Demonstration of histology specimen is carried out with the help of a multimedia installation and TV.

pr.tr.47 "Thyroid, parathyroid glands, adrenal glands." (full-time course)

Thyroid gland. The structure of the thyroid gland, tissue and cell composition, structural and functional unit. Phase of production in secretory cycle of thyrocytes. Parafollicular cells, their role. 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. General morphofunctional characteristics of the adrenal glands. The structure 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. The role of adrenal hormones. 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. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of histology specimen (thyroid gland, parathyroid glands, adrenal glands) using light microscopes and electrongrams. Demonstration of histology specimen is carried out with the help of a multimedia installation and TV. In addition, studying the topic, it is envisaged to solve a practice-indicative task. Computer testing in a computer class.

Topic 17. The test control of the Module IV «Special Histology of regulatory and sensory systems».

pr.tr.48 "The test control of the Module IV «Special Histology of regulatory and sensory systems»." (full-time course)

The test and theoretical control of topics 12-16.

pr.tr.49 "The test control of the Module IV «Special Histology of regulatory and sensory systems»." (full-time course)

Control of practical skills on topics 12-16.

Topic 18. Digestive system.

lect.9 "Digestive system." (full-time course)

General morphofunctional characteristics of digestive system. Embryogenesis of the digestive system. Digestive channel. General plan of structure of wall. Innervation and vascularisation. Oral cavity. Morphological characteristics of esophagus and pharynx. Morphological characteristics of the wall of the esophagus in different parts. General morphological and functional characteristics of the stomach. Characterization of the gastric glands. General characteristics and functions of the small and large intestine. Teaching is carried out in the form of multimedia interactive lectures (in the presence of quarantine - in the online mode).

pr.tr.50 "Organs of oral cavity." (full-time course)

General morphofunctional characteristics of digestive system. Embryogenesis of the digestive system. Digestive channel. General plan of structure of wall. Oral cavity. Features of structure of different organs in oral cavity. Features of the structure of the lips, cheek, gums, tonsils, tongue. Organ of taste. General characteristics. Embryogenesis. Taste buds, their localization and structure. Taste, supporting and basal cells. Histophysiology of the organ of taste. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of histology specimen (filiform papillae of the tongue, fungiform papillae of the tongue) using light microscopes and electrongrams. Demonstration of histology specimen is carried out with the help of a multimedia installation and TV. In addition, studying the topic, it is envisaged to solve a practice-indicative task. Computer testing in a computer class.

pr.tr.51 "Large salivary glands." (full-time course)

The general plan of the structure of the salivary glands. Structure and types of final secretory departments. Structure and functions of the system ducts. Morphofunctional characteristic of the parotid, submandibular and submandibular salivary glands. Embryogenesis and regeneration of the salivary glands. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of histology specimen (the parotid, submandibular and submandibular salivary glands) using light microscopes. Demonstration of histology specimen is carried out with the help of a multimedia installation and TV. In addition, studying the topic, it is envisaged to solve a practice-indicative task. Computer testing in a computer class.

pr.tr.52 "The structure and development of teeth" (full-time course)

Teeth. General plan of structure. Types of teeth. Tooth tissue: enamel, dentin, cement. Development of baby and permanent teeth. The clinical significance of violations of the early stages of tooth development. Histogenesis of tooth tissues. The structure and significance of the pulp. Enamel, dentin, cement - structure, chemical composition, function. Structure and function of periodontal and gingiva. Parts of the tooth. Crown surfaces. Age-related changes in teeth. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of of histology specimen (development of the ename organ, histogenesis of tooth tissues) using light microscopes. Demonstration of histology specimen is carried out with the help of a multimedia installation and TV. In addition, studying the topic, it is envisaged to solve a practice-indicative task. Computer testing in a computer class.

pr.tr.53 "Esophagus. Stomach." (full-time course)

Morphological characteristics of esophagus and pharynx. Morphological characteristics of the wall of the esophagus in different parts. General morphological and functional characteristics of the stomach. Characterization of the gastric glands. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of histology specimens (esophagus, junction between esophagus to stomach, body of stomach) using light microscopes. Demonstration of histology specimen is carried out with the help of a multimedia installation and TV. In addition, studying the topic, it is envisaged to solve a practice-indicative task. Computer testing in a computer class.

pr.tr.54 "Small and large intestine." (full-time course)

General characteristics and functions of the small and large intestine. Histophysiology of the crypt-villus system. Features of structure of the duodenum. Large intestine.Features of the relief of the mucous membrane. Histophysiology of the colon. The appendix, structure and function. The structure of the rectum. Endocrine apparatus of the digestive canal, its structure and functions. Regeneration of the epithelium in different parts of the digestive canal. Age-related changes. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of histology specimens (duodenum, small intestine, large intestine) using light microscopes and electrograms. Demonstration of histology specimen is carried out with the help of a multimedia installation and TV. In addition, studying the topic, it is envisaged to solve a practice-indicative task. Computer testing in a computer class.

pr.tr.55 "Liver. Pancreas." (full-time course)

The microscopic and ultramicroscopic structure of exocrine and endocrine parts of the pancreas. Hormones and their significance. General characteristics and functions of the liver. Liver development. Features of blood supply to the liver. Morphological characteristics of the gallbladder and biliary tract. Age-related changes in liver. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of histology specimens (pancreas, liver of pig ang humman) using light microscopes and electrograms. Demonstration of histology specimen is carried out with the help of a multimedia installation and TV. In addition, studying the topic, it is envisaged to solve a practice-indicative task. Computer testing in a computer class.

Topic 19. Respiratory system.

pr.tr.56 "Organs of the respiratory system." (full-time course)

Morphofunctional characteristics. Respirator and unrespirator functions, respiratory ways. Sources of development. General plan of structure of wall of respiratory ways. Characterization of the membranes of respiratory ways. Characteristics of respiratory epithelial cells (ciliated cells, goblet, basal, high plug-in, Clara cells, endocrinocytes, dendritic cells). The concept of broncho-associated lymphoid tissue, its significance for the body. The sense of smell. General characteristics. Embryogenesis. Localization. Characterization of the olfactory region. Histophysiology of the organ of smell. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of histology specimens (trachea,large bronchus, small bronchus) using light microscopes and electrograms. Demonstration of histology specimen is carried out with the help of a multimedia installation and TV. In addition, studying the topic, it is envisaged to solve a practice-indicative task. Computer testing in a computer class.

pr.tr.57 "Organs of the respiratory system. Lungs." (full-time course)

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. Age - dependent changes. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of histology specimen (lung) using light microscopes and electrograms. Demonstration of histology specimen is carried out with the help of a multimedia installation and TV. In addition, studying the topic, it is envisaged to solve a practice-indicative task. Computer testing in a computer class.

Topic 20. Skin. Derivatives skin.

pr.tr.58 "Skin. Derivatives skin." (full-time course)

Skin functions and its significance. The tissue composition of the skin. Regeneration. Epidermis. Its layers, features of the structure of "thick" and "thin" skin. Keratinocytes. Processes keratinization in the epidermis. Tactile epitheliocytes. Dermis. Papillary and reticular layers. Features of the structure of the dermis in different areas of the skin. 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. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of histology specimen (skin, skin with hiar) using light microscopes and electrograms. Demonstration of histology specimen is carried out with the help of a multimedia installation and TV. In addition, studying the topic, it is envisaged to solve a practice-indicative task. Computer testing in a computer class.

Topic 21. Urinary system.

lect.10 "Urinary system." (full-time course)

General plan of organization of the urinary system. Embryogenesis. Sources and basic stages of development. Kidney. . The general plan of the structure. Characterization of the mucous membrane of the urinary tract. The structure of the muscular and external membranes of the urinary organs. Bladder. Age-related changes in bladder. Teaching is carried out in the form of multimedia interactive lectures (in the presence of quarantine - in the online mode).

pr.tr.59 "Kidney development. Histophysiology of nephron." (full-time course)

General plan of organization of the urinary system. Embryogenesis. Sources and basic stages of development. Age - dependent changes. Kidney. The general plan of the structure. General characteristics of nephrons. Features of blood supply of the kidneys. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of histology specimen (kidney) using light microscopes and electrograms. Demonstration of histology specimen is carried out with the help of a multimedia installation and TV. In addition, studying the topic, it is envisaged to solve a practice-indicative task. Computer testing in a computer class.

pr.tr.60 "Endocrine kidney apparatus. Urinary tract." (full-time course)

Endocrine apparatus of the kidney. Features of blood supply of the juxtamedular nephrons. Characterization of the mucous membrane of the urinary tract. The structure of the muscular and external membranes of the urinary organs. Bladder. Age-related changes in bladder. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of histology specimen (urinary passages, bladder) using light microscopes and electrograms. Demonstration of histology specimen is carried out with the help of a multimedia installation and TV. In addition, studying the topic, it is envisaged to solve a practice-indicative task. Computer testing in a computer class.

Topic 22. Reproductive system.

lect.11 "Male and female reproductive system." (full-time course)

The general plan of the structure of the male reproductive system. Embryogenesis of the male reproductive system. Testis. Structure. Embryonic and post-embryonic histogenesis. Functions. Spermatogenesis. Concept of a hematotesticular barrier. Variants and anomalies of development of male genitals. Female reproductive organs. Ovaries. Ovogenesis. Changes during the ovarian-menstrual cycle, their hormonal regulation. The value of atretic follicles for the functioning of the female reproductive system. Oviducts and vagina. Teaching is carried out in the form of multimedia interactive lectures (in the presence of quarantine - in the online mode).

pr.tr.61 "Male reproductive system.Testis." (full-time course)

The general plan of the structure of the male reproductive system. Embryogenesis of the male reproductive system. Testis. Structure. Embryonic and post-embryonic histogenesis. Functions. Spermatogenesis. Concept of a hematotesticular barrier. Endocrynocytes of the testis, their function. Morphological characteristics of the sustentocytes. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of histology specimen (testis) using light microscopes and electrograms. Demonstration of histology specimen is carried out with the help of a multimedia installation and TV. In addition, studying the topic, it is envisaged to solve a practice-indicative task. Computer testing in a computer class.

pr.tr.62 "Male reproductive system.Excurrent ducts." (full-time course)

Excurrent ducts.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. Bulburethral glands. Embryogenesis and structure of the prostate gland, its age-related changes. Prostaglandins, their significance. Variants and anomalies of development of male genitals. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of histology specimens (epididymis, prostate glands) using light microscopes and electrograms. Demonstration of histology specimen is carried out with the help of a multimedia installation and TV. In addition, studying the topic, it is envisaged to solve a practice-indicative task. Computer testing in a computer class.

pr.tr.63 "Female reproductive system. Ovaries." (full-time course) Female reproductive organs. Ovaries. Ovogenesis. Changes during the ovarian-menstrual cycle, their hormonal regulation. The value of atretic follicles for the functioning of the female reproductive system. Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of histology specimen (ovaries) using light microscopes and electrograms. Demonstration of histology specimen is carried out with the help of a multimedia installation and TV. In addition, studying the topic, it is envisaged to solve a practice-indicative task. Computer testing in a computer class.
pr.tr.64 "Female reproductive system. Uterus. Fallopian tubes." (full-time course) General structural features of the uterus. Histophysiology of the fallopian tubes. Oviducts and vagina. Ovarian-menstrual cycle.The mammary gland. Development, structure and functions. Hormonal regulation of the mammary gland.Studying the topic involves theoretical and practical work in the classroom, the use of virtual simulation (watching movies), the method of demonstrations with further discussion; study of histology specimens (uterus. fallopian tubes) using light microscopes and electrograms. Demonstration of histology specimen is carried out with the help of a multimedia installation and TV. In addition, studying the topic, it is envisaged to solve a practice-indicative task. Computer testing in a computer class.
Topic 23. The test control of the Module V «Special Histology and Embryology of internal organs».
pr.tr.65 "The test control of the Module V «Special Histology and Embryology of internal organs»." (full-time course) The test and theoretical control of topics 18-22.
pr.tr.66 "The test control of the Module V «Special Histology and Embryology of internal organs»." (full-time course) Control of practical skills on topics 18-22.
pr.tr.67 "Preparation for the integrated test exam "Step-1"" (full-time course) Testing on questions from the database "Step-1" in the exam mode.
pr.tr.68 "Diagnostics of histology specimens." (full-time course) Diagnostics of histology specimens.

7.2 Learning activities

LA1	Preparation for practical classes.
LA2	Study of histology specimen using the light microscope and electronic microphotographs.
LA3	Solving practice-oriented situational tasks and analysis of specific situations on the topics of practical classes.
LA4	Execution of computer tests.
LA5	Preparation for Step-1.

LA6	Work with textbooks and relevant information sources.
LA7	Preparation of multimedia presentations.
LA8	Preparation for content modules within the topics of discipline content and final control (exam).
LA9	Watching educational films.
LA10	E-learning in systems (Google Meet, MIX.sumdu.edu.ua).
LA11	Self-study.
LA12	Individual research project (student research paper, article, thesis, etc.).

8. Teaching methods

Course involves learning through:

TM1	Interactive lectures.
TM2	Case-based learning (CBL).
TM3	Demonstration method.
TM4	Team-based learning.
TM5	Business game.
TM6	Research-based learning.
TM7	Educational discussion / debate.

The teaching of discipline occurs with the use of modern teaching methods (CBL, TBL, RBL) that promote the development of professional abilities, stimulate creative and scientific activities and aimed at preparing practical oriented specialists.

The discipline provides students with the following soft skills: SC 2. Ability to determine the required set of laboratory and instrumental studies and to evaluate their results. SC 3. Ability to establish a provisional and clinical diagnosis of disease. SC 7. Ability to solve medical problems in new or unfamiliar environments given incomplete or limited information, taking into account aspects of social and ethical responsibility.

9. Methods and criteria for assessment

9.1. Assessment criteria

ECTS	Definition	National scale	Rating scale
	Outstanding performance without errors	5 (Excellent)	$170 \leq RD \leq 200$
	Above the average standard but with minor errors	4 (Good)	$140 \leq RD < 169$
	Fair but with significant shortcomings	3 (Satisfactory)	$120 \leq RD < 139$
	Fail – some more work required before the credit can be awarded	2 (Fail)	$0 \leq RD < 119$

9.2 Formative assessment

FA1	Peer assessment
FA2	Defense of an individual research project (presentation at a conference, competition of scientific works).
FA3	Teacher's instructions in the process of practical tasks.
FA4	Teacher's surveys and oral comments on its results.
FA5	Verification and evaluation of written tasks.
FA6	Solving situational problems.
FA7	Testing.

9.3 Summative assessment

SA1	Survey, evaluation of written works, solving practice-oriented tasks, testing.
SA2	Final control: practice-oriented exam (according to the regulations).
SA3	Protection of an individual research project (incentive activity, additional points).

Form of assessment:

2 semester		**200 scores**
SA1. Survey, evaluation of written works, solving practice-oriented tasks, testing.		**120**
	Oral and/or written survey, solution of situational problems, ongoing computer testing, testing on the database of licensed exam "Step 1".	120
SA2. Final control: practice-oriented exam (according to the regulations).		**80**
	Passing the exam (theoretical and practical parts).	80

Form of assessment (special cases):

2 semester		**200 scores**
SA1. Survey, evaluation of written works, solving practice-oriented tasks, testing.		**120**
	Under quarantine restrictions, practical classes are held on-line using Mix.SumDU and Google Meet platforms	120
SA2. Final control: practice-oriented exam (according to the regulations).		**80**
	Conducting the exam in online format using Mix.SumDU and Google Meet platforms under quarantine restrictions.	80

For current activities at each practical session, students receive grades for theoretical training, which is checked by computer testing and surveys (oral or written). Maximum 5 points (the score is set in the traditional 4-point rating system). At the end of the academic year, the average arithmetic performance of the student is calculated. The maximum number of points a student can get in practical classes during the school year is 120. The number of points of the student is calculated according to the formula 120 multiplied by the arithmetic average and divided by 5. The form of

final control is an exam.Students are admitted to the exam under conditions: the minimum number of points for practical classes is 72 points; availability of a properly designed and fully signed album with histology specimen; compiled for positive assessments of all content modules and computer testing on the task "Step-1" not less than 80%. The exam is carried out due to computer testing, which includes: theoretical questions - 40 tests from the whole course of histology, 40 tests - practical issues, which include virtual diagnostics of histology specimens. The exam is credited to the student if he scored at least 48 points out of 80. Incentive points are added to the assessment in the discipline for: theses in the scientific collection - 10 points, performance at the scientific conference - 10 points. The total score in the discipline can not be more than 200.

10. Learning resources

10.1 Material and technical support

MTS1	Library funds.
MTS2	Graphic tools: diagrams, posters.
MTS3	Computers, Computer Systems and Networks.
MTS4	Laboratory equipment: microscopes and histology specimen.
MTS5	Layouts and mules of individual organs.
MTS6	Multimedia, video and sound reproducing, projection equipment (video cameras, posters, screens, laptops).
MTS7	Software (for maintaining distance learning, internet poll), integrated information system (Web system of the SSU, E-Learning Information System).
MTS8	Information and communication systems.
MTS9	Technical means (educational video materials).

10.2 Information and methodical support

Essential Reading	
1	Melnyk, N.O. Histology, cytology and embryology (short course) / N. O. Melnyk. — K. : Book-plus, 2018. — 312 c.
2	Mescher A. L. “Junqueira's Basic Histology: Text & Atlas”. – 2018.
3	Eroschenko, V. P. Atlas of Histologi with Functional Correlations / V. P. Eroschenko. — thirteenth edition. — Philadelphia : Wolters Kluwer, 2017. — 617 p.
4	Melnyk, N. O. Histology, cytology, embryology. Practical guide / N. O. Melnyk. — K. : Book-plus, 2018. — 43 c.
5	Gartner, L. P. Textbook of Histology / L. P. Gartner. — 4-th ed. — Philadelphia : Saunders Elsevier, 2017. — 656 p.
Supplemental Reading	

1	The long-term effect of the complex of heavy metal salts on the morphofunctional changes in the structural components of the intermediate lobe of the mature rat's pituitary gland-the female / Romanyuk A.M., Hryntsova N.B., Kiptenko L.I., ...Ustyansky O.O., Dunaeva, M.M. // Problemi Endokrinnoi Patologii. – 2019. – Vol. (2). - P. 98-103. (Scopus)
2	Morphological characteristics and correction of long tubular bone regeneration under chronic hyperglycemia influence / Dudchenko Y.S., Maksymova O.S., Pikaliuk, V.S., Muravskyi, D.V., Kiptenko, L.I., Tkach, G.F. // Analytical Cellular Pathology . – 2020. – Vol. 2020. Article ID 5472841, 7 pages. doi.org/10.1155/2020/5472841 (Scopus)
3	Cholinesterase in different types of the muscle tissue during the early postmortem period for diagnosis of death coming / Cherkashyna L., Shklyar A., Sukhonosov R., Miroshnikova O., Naguta L., Olkhovskiy V., Demikhova N., Kuts L., Barchan G., Sukhomlyn G., Kiptenko L. // Bangladesh Journal of Medical Science. – 2021. - Vol. 20. - № 01 January'21. – P. 95-100. (Scopus)
Web-based and electronic resources	
1	https://www.lecturio.com/about-us/