

**Entrance exam program
in training of highly qualified personnel
(Ph.D. programme)**

3.3 “BIOMEDICAL SCIENCES”

Entrance exam program for the postgraduate Ph.D. programme in training of highly qualified personnel 3.3 “BIOMEDICAL SCIENCES” includes the following sections:

"Human Anatomy"

Methods of studying anatomy. Anatomy's connection with related disciplines. Stages of embryogenesis, the main morphological changes in the initial stages of embryogenesis. Peculiarities of formation and subsequent importance for embryo- and organogenesis of embryonic sheets and axial complex of organs. Axes and planes of the human body used in the study of all sections of the subject. The doctrine of bones - osteology. General information about the anatomy of the skeleton, classification of bones. Bone as an organ, periosteum, bone cavity, bone marrow. Structure of bone; diaphysis, metaphysis, epiphysis, apophysis, osteon, compact and cancellous substance. Chemical composition of bones and their physical properties. Anatomical nomenclature. The planes and axes of the body. Doctrine of joints of bones - syndesmology. Joints of bones in phylogenesis. Classification of bone connections. Functional anatomy of syndesmosis, synchondroses, synostoses, semi-joints. Classification of joints. Main and auxiliary elements of joints. Basic laws of biomechanics of joints. Doctrine of muscles - myology. General characteristic of muscle tissue. The concept of phylo- and ontogenesis of skeletal muscles. Classification of muscles, general characteristics of separate functional muscle groups: agonists, antagonists, synergists. Structure of muscle as an organ. Anatomical, physiological cross-section of a muscle. Neuromotor unit. Role and regularities of fascia development in muscular system according to N.I. Pirogov. The doctrine of internal organs - splanchnology. The main sources of formation in embryogenesis of the digestive, respiratory and urogenital systems. General principles of the structure of hollow and parenchymatous organs. The concept of the topography of internal organs. Digestive system. The concept of phylo- and ontogenesis of the digestive system. Development of the tissue structures of the digestive tube. Respiratory system. Phylo- and ontogenesis of the organs of the respiratory system. Respiratory system, general characteristics of the gas exchange process. The system of organs of the urogenital system. Endocrine glands. Classification of endocrine glands, peculiarities of anatomy and

topography. Lymphatic system. The role of domestic scientists in the study of the lymphatic system - Iosifov G.I., Zhdanov D.I. Organs of hematopoiesis and immune system. Bone marrow, topography, structure, age-related changes. Nervous system - neurology. Central nervous system. Peripheral nervous system. Spinal nerves. Cranial nerves. Autonomic (autonomic) nervous system. Laws of development and functions of the autonomic nervous system. Division of the autonomic nervous system into sympathetic and parasympathetic parts. The doctrine of the sense organs - aesthesiology. Anatomical and functional characteristics of the sense organs, analyzers.

Reference List:

1. human anatomy (vol.1, 2). - Ed. by M.R. Sapin. - M.: Medicine, 2010. - 1104 p.
2. Gaivorovsky I.V. Anatomy and physiology of man: textbook / I.V. Gaivorovsky. -M., 2013.

"Pathological Anatomy"

Damage, cell and tissue death. Morphology of damage. Apoptosis. Intracellular accumulation. Lipid accumulation (lipidosis). Protein accumulation (dysproteinosis). Glycogen accumulation. Disorders of pigment metabolism (chromoproteins). Pathological calcifications (calcinosis). Hyalinic changes. Equilibrium disorders of fluid media and disorders of blood and lymph circulation. Disorders of water-electrolyte balance. Circulatory disorders. Shock. Hemostasis. Bleeding. Thrombosis. Embolism. Ischemia. Infarction. Inflammation, healing, and recovery. Acute inflammation. Chronic inflammation. Granulomatous inflammation (acute and chronic). Mediators of inflammation. Cellular and molecular processes in inflammation. Morphological manifestations of acute and chronic inflammation. General manifestations of inflammation. Reparation, regeneration, wound healing. Pathological aspects of inflammation and regeneration. Pathology of the immune system. Hypersensitivity reactions. Autoimmunization and autoimmune diseases. Syndromes of immune deficiency. Pathology of cell growth and differentiation. Adaptation processes. Cell growth and differentiation of cells. Role of extracellular matrix and cell-matrix interactions. Adaptation processes. Tumors. The most important clinical and morphological manifestations of tumor growth. Risk factors of tumor growth. Molecular basis of carcinogenesis. Biology of tumor growth. Carcinogenic agents and their interaction with cells. Antitumor immunity. Genetic diseases. Diseases which evolve according to Mendelian law. Diseases with multifactorial inheritance. Cytogenetic diseases (chromosomal disorders). Diseases with non-classical inheritance, caused by a single gene. Pathology caused by

environmental factors and nutrition. Significance of the environment and human pathology. Air pollution. Chronic drug exposures. Diseases caused by physical factors. Diseases associated with nutrition. Essential sections of the doctrine of diagnosis. Medical determination of death. Basic principles of the doctrine of diagnosis. Signs of death and post-mortem changes. Diseases of the blood vessels and heart. Atherosclerosis and arteriosclerosis. Hypertension and arteriosclerosis. The main types of iatrogenic pathology occurring in the treatment of vascular disease. Coronary heart disease (coronary artery disease). Diseases of heart valves and orifices and main arteries. Diseases of myocardium of established etiology (specific diseases). Diseases of the pericardium. Pathology of blood cells and bone marrow. Anemias. Tumors of hematopoietic tissue (leukemia). Myeloproliferative diseases. Myelodysplastic syndrome. Tumors of plasma cells. Thrombocytic diseases. Coagulopathy. Diseases of the lymphoreticular system organs. Infectious and non-parasitic diseases. Bacteremia and sepsis. Infections affecting mainly the respiratory organs. Infections affecting mainly the gastrointestinal tract. Purulent infections caused by gram-positive bacteria. Infections caused by anaerobic pathogens. Sexually transmitted or predominantly sexually transmitted infections. Childhood and adolescent infections. Opportunistic infections and AIDS. Anthrozoönotic and vector-borne infections. Tropical infections. Diseases of the respiratory system. Diseases of digestive system organs. Cystic kidney diseases. Glomerular diseases of the kidneys. Acute glomerulonephritis. Nephrotic syndrome. Chronic glomerulonephritis. Damage to the renal glomeruli associated with systemic diseases. Other systemic diseases with renal damage. Renal diseases associated with damage to the tubules and interstitium. Pyelonephritis and urinary tract infections. Tubulointerstitial nephritis caused by drugs and toxins. Urate nephropathy is acute and chronic (gouty). Nephrolithiasis. Pathology and morphogenesis. Benign and malignant (malignant phase of hypertension) nephrosclerosis. Renal artery stenosis. Obstruction of the urinary tract (obstructive uropathy). Hydronephrosis. Urolithiasis (kidney stones). Renal tumors, classification. Diseases of the male genital system. Diseases of the prostate gland. Diseases of testicles and testicular appendages. Diseases of mammary glands. Diseases of the breasts in men. Gynecomastia. Diseases of female genital organs. Diseases of the vulva and vagina. Diseases of the uterus. Illnesses of the fallopian tubes. Diseases of the ovaries. Pathology of pregnancy and postpartum period. Pre- and postnatal disorders, diseases of infancy and childhood. Birth trauma and birth injuries. Congenital malformations. Intrauterine infections. Hemolytic disease of newborns. Sudden death syndrome. Tumors in children. Endocrine disorders. Diseases of the pituitary gland. Diseases of the thyroid gland. Diseases of the parathyroid

gland. Diseases of the adrenal glands. Diseases of the thymus. Diseases of the pineal gland. Multiple endocrine neoplasia (MEN). Diseases of the musculoskeletal system. Diseases associated with abnormalities of the bone matrix. Diseases caused by osteoclast dysfunction. Osteonecrosis. Osteomyelitis. Malignant melanoma. Benign epithelial tumors. Acute dermatoses. Chronic inflammatory dermatoses. Psoriasis, lupus erythematosus, rubber lichen planus. Diseases of the central nervous system, peripheral nerves. Craniocerebral trauma. Cerebrovascular disease. Infarction (ischemic stroke) of the brain. Selective necrosis of neurons (ischemic encephalopathy). Spontaneous intracranial hemorrhage. Infectious diseases of the central nervous system. Non-negative infections of the central nervous system. Tuberculous meningitis. Neurosyphilis. Fungal infections. Viral infectious diseases of the central nervous system. Slow viral neuroinfections and prion diseases (kuru, Creutzfeldt-Jakob disease, prion diseases of animals). Demyelinating diseases. Metabolic diseases of the central nervous system. Diseases of the central nervous system associated with various types of insufficiency, intoxication and radiation therapy. Changes in aging, degenerative processes and dementia. Systemic diseases of the central nervous system. Tumors of the central nervous system. Diseases of peripheral nerves and paraganglia.

Reference List:

1. Pathological anatomy [Electronic resource] : national handbook. / [M.A. Paltsev et al.] ; edited by M.A. Paltsev [et al.]. - Moscow : GEOTAR-Media, 2013. - 1259 p.
2. Strukov A.I. Pathological anatomy [Text] : [textbook for higher professional education] / A.I. Strukov, V.V. Serov ; ed. C. Paukova. - 6th edition. - Moscow : GEOTAR-Media, 2015.
3. Pathological anatomy [Text] : atlas : [textbook for higher professional education] / [O.V. Zayrat'yants, S.P. Boykova, L.A. Zotova et al.] ; ed. by O.V. Zayrat'yants. - Moscow : GEOTAR-Media, 2012.
4. Poryadin, G.V. History of General Pathology [Text] : people and facts / G.V. Poryadin, Y.V. Balyakin, J.M. Salmasi. - Moscow : Litterra, 2013. - 200 p.

"Pathological Physiology"

Subject matter and tasks of pathological physiology. The place of pathological physiology in modern medical science. Definition of the concepts of "health" and "disease". Definition of "pathogenesis". Definition of the concept of "sanogenesis". Disease, periods of disease. Reactivity. Cell pathophysiology. Regional typical pathological processes. Disorders of local blood circulation. Arterial hyperemia. Inflammation. Typical disorders of metabolism.

Pathology of heat metabolism of the body. Disorders of input-salt metabolism. Edemas. Disorders of the acid-base state of the body. Violations of protein metabolism. Disorders of fat metabolism. Hyper- and hyperlipidemia. Metabolic disorders of carbohydrates. Diabetes mellitus. Pathophysiology of avitaminosis and disorders of mineral metabolism. Hypoxia. Immunopathology. Pathophysiology of immunity. Allergy. Pathophysiology of tissue growth. Tumors. Pathophysiology of terminal states. Pathophysiology of pain. Stress (adaptation syndrome). Shock, collapse, coma. Dying and reviving of organisms. Pathophysiology of biorhythms. Pathophysiology of hereditary diseases. Diseases of civilization. Private pathological physiology. Blood and blood production. Anemias. Pathophysiology of hemoglobinosis. Leukocytosis and leukopenia. Leukemias and leukemoid reactions. Hemorrhagic diathesis. Cardiovascular system. Pathophysiology of the heart. Arrhythmias, definition of the concept and classification. Pathophysiology of myocardial necrosis. Cardiomyopathies. Myocarditis, endocarditis and pericardial disease. Cardiac malformations. Heart failure. Pathophysiology of vascular tone. Pathophysiology of atherosclerosis. Pathophysiology of respiratory system. Digestive system. Pathophysiology of pancreatic gland dysfunction. Pathophysiology of the liver. The excretory system. Modern views on the process of urination and its regulation. Acute diffuse glomerulonephritis. Pyelonephritis. Renal stone disease, exogenous and endogenous etiological factors. Renal insufficiency, changes in blood and urine composition. Endocrine system. Pathophysiology of the nervous system. Pathophysiology of drug addiction. Infectious process. Definition of infectious process. Immune defense factors in the development of the infectious process. The role of environmental, social and epidemiological factors in the development of infection. Periods of infectious disease and their pathophysiological analysis.

Reference List:

1. Litvitsky P.F. Pathological physiology: a textbook. In 2 volumes. Moscow: GEOTAR Media, 2014.
2. Chereshev V.A., Yushkov B.G. Pathophysiology: textbook. M., 2014. - 836 p.

"Pharmacology, clinical pharmacology"

The subject and objectives of clinical pharmacology, sections of clinical pharmacology, the main legal and ethical aspects of the use of medicines, the principles of organization and basic clinical and pharmacological service in health care institutions. Principles of developing

programs to monitor the effectiveness and safety of drugs, the methodology for assessing the impact of medicines on quality of life. The concepts of antagonists, agonists, partial agonists, the main drug target molecules. The concept of adverse drug reactions. Features of the pharmacokinetics and pharmacodynamics of drugs in pregnant women and the fetus. Peculiarities of pharmacokinetics and pharmacodynamics of drugs in children. The concept of the formulary system. Adverse drug reactions. Overdose of the drugs. Interaction of drugs. Features of pharmacokinetics and pharmacodynamics of drugs in pregnant women and the fetus. Categories of drugs by degree of risk to the fetus by the WHO: A, B, C, D, E, X. Teratogenicity, embryotoxicity and fetotoxicity of drugs. Clinical pharmacogenetics. Pharmacogenomics. Genetic characteristics of patients that influence drug pharmacokinetics: gene polymorphisms of drug metabolism enzymes; gene polymorphisms of drug transporters. Organization of clinical pharmacogenetics laboratory activities in a multidisciplinary hospital. Clinical pharmacoconomics. Clinical pharmacoepidemiology: types of pharmacoepidemiological analysis (ABC-VEN analysis, drug consumption review), established daily dose (DDD). Clinical trials of drugs. The concept of randomized controlled trials. Evidence-based medicine: principles, levels (classes) of evidence. "Endpoints" of clinical trials. Meta-analysis. Pharmacokinetics, pharmacodynamics, indications, contraindications, adverse drug reactions, interaction of the following drugs. Drugs that reduce vascular tone. Antiarrhythmic drugs. Inotropic drugs. Diuretics. Pharmacokinetics, pharmacodynamics, indications, contraindications, adverse drug reactions, interaction of the following drugs.

Reference List:

1. Kharkevich D.A. Pharmacology [Electronic resource] : [textbook for medical universities] / D.A. Kharkevich. - 11th ed. updated and supplementary. - Moscow : GEOTAR-Media, 2013. - 760 p.
2. Clinical pharmacology [Text] : a national guide / ed. by Y. B. Belousov and 3 others. ; Quality Association of Medicine. - Moscow : GEOTAR-Media, 2012. - 965 p. + CD. - (National guidelines). - On the front page. : Priority national projects "Health".
- Drugs in Russia [Electronic resource] : VIDAL Handbook, 2016. - M., 2016. - URL : <http://www.vidal.ru>.
4. Clinical pharmacology [Text] : textbook for students of medical universities / V. G. Kukes, D. A. Andreev, V. V. Arkhipov et al. Under the editorship of V. G. Kukes. Kukes. - 4-th ed., revised and updated - Moscow : GEOTAR-Media, 2014. - 1052 p. + CD