

Curriculum is based on the standard educational program “Pathological Physiology”, approved on November 18, 2015, registration # TD- L.532/typ.

COMPILERS:

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RECOMMENDED FOR APPROVAL:

by the Pathological Physiology Department of the Educational Institution «Belarusian State Medical University”
(protocol № 10 of May 29, 2018);

by the Methodological Commission of Biomedical Disciplines of the Educational Institution «Belarusian State Medical University»
(protocol № 10 of June 13, 2018)

EXPLANATORY NOTE

Pathological Physiology is the science and discipline of the vital activity of a diseased organism, of the nature and mechanisms of disease resistance, the study of general regularities of the origin, development and outcome of the disease, characterized by the rapid growth of basic and applied knowledge.

The curriculum of the discipline «Pathological Physiology» includes the latest scientific data on the molecular pathology, modeling and experimental therapy of the most common diseases and morbid states. The new teaching curriculum sets objectives of the study and teaching of the discipline aimed at developing students' academic, social, personal and professional competence.

The aim of teaching and learning the discipline of pathophysiology is to provide the students with the scientific knowledge of the general patterns and specific mechanisms of the onset, development and outcomes of pathological processes, individual diseases and morbid states, the principles of their detection, therapy and prevention.

The purpose for studying the discipline is to develop the student's academic competences, based on the ability to self-search educational and information resources, as well as acquire and understand the knowledge of:

- basic concepts of general nosology, the causes and conditions of the external and internal environment, as well as the reactive properties of the organism in the onset, development and outcome of the disease;
- causes and mechanisms of typical pathological processes and reactions, and their importance for the organism and manifestation of disease development;
- causes, mechanisms, and the most important manifestations of typical disorders of organs and functional systems of the organism;
- main risk factors for noninfectious diseases (cardiovascular, cancer, metabolic diseases);
- pathophysiology principles that form the basis for etiological and pathogenetic therapy.

The tasks of teaching the discipline include the formation of students' social, personal and professional competences, based on the knowledge and application of:

- research methods that encourage the formation of clinical thinking on compliance with the rules of medical ethics and deontology;
- methods of the pathophysiological analysis of simulated pathology and clinical situations for teaching the use of pathophysiological principles in selecting optimal means and methods of disease prevention and treatment.

Teaching and successful study of the discipline «Pathological Physiology» is carried out on the basis of students acquired knowledge and skills in sections of the following disciplines:

General Chemistry. Electrolyte composition of blood, blood buffer systems. Acid-base status.

Medical and Biological Physics. Dose characteristics of ionizing radiation. Electric current parameters. Converting electrical energy into other forms of energy.

Medical Biology and General Genetics. Heredity and variation, types of inheritance, genotype and phenotype. Methods of research in medical genetics.

Biological Chemistry. Clotting, anticoagulants and blood fibrinolytic systems. Mechanisms of hemostasis.

Histology, Cytology, Embryology. Genesis of blood cells. Types and periods of hematopoiesis.

Normal Physiology Function. Laws of functioning of cells, tissues, organs and systems of healthy body and their regulation mechanisms. Indicators of healthy body functioning, widely used in medicine practice, and their parameters in norm.

Microbiology, Virology, Immunology. The notion of immunity and allergy, general characteristic of cellular and humoral immunity reactions

As a result of studying the discipline «Pathological Physiology» the student should

know:

- basic concepts of general nosology;
- reasons, basic mechanisms of development and outcomes of typical pathological processes;
- basic regularities and mechanisms of disease development and human being recovery;
- compensation mechanisms and correction principles of structural and functional disturbances during typical pathological processes;
- role of experimental research in pathological processes study, their capabilities, limitations and prospects, as well as requirements for the researcher and experimenter;

be able to:

- identify and assess pathological and compensatory adaptive reactions, functional reserves of the body in various forms of pathology of organs and systems;
- identify the main types of cardiac arrhythmias, respiratory dysfunctions, liver and kidney dysfunctions according to clinical and other research methods;
- identify typical disturbance of external respiration by characteristics of ventilation and blood gases;
- identify typical disturbances of gastric secretory function according to an the analysis of gastric juice;
- identify abnormal cells in blood smears cells;
- carry out complete pathogenic blood count analysis of patients with various forms of pathology;
- to give an conclusion for the complete blood count of a typical pathologies pathology of the blood system, assess the severity of any changes: to judge the

functional state of the hematopoietic system, its compensatory adaptive capabilities, severity and reversibility of deviations; recognize pathological processes in which such changes are possible;

– use the knowledge of pathological physiology in study of clinical disciplines and following further medical activities.

Total number of hours for the study of the discipline is 252 academic hours. Classroom hours according to the types of studies: lectures - 20 hours, laboratory studies (practical classes - 99 hours, student independent work (self-study) - 133 hours.

Current assessment is carried out according to the syllabus of the specialty in the form of a credit (6-th semester), and examination (7-th semester).

Form of higher education is full-time.

ALLOCATION OF ACADEMIC TIME ACCORDING TO SEMESTERS OF STUDY

Code, name of the specialty	semester	Number of academic hours					Form of current assessment
		total	in-class	including		out-of-class self-studies	
				lectures	laboratory studies (practical classes and seminars)		
1-79 01 08 «Pharmacy»	6	108	62	11	51	46	Credit
	7	144	57	9	48	87	Exam
Total number of hours		252	119	20	99	133	

THEMATIC PLAN

Section	The number of training sessions hours	
	lecturers	practical
1. General nosology	3	15
1.1. Introduction to the subject "Pathological physiology". Subject, tasks and methods of Pathophysiology. General questions about the disease teachings. The doctrine of the etiology and pathogenesis	1	3
1.2. Reactivity of the organism, its role in pathology. The role of heredity in pathology. Pathophysiology of an aging organism	2	6
1.3. Pathogenic action of environment factors	-	6
2. Typical pathological processes	8	36
2.1. Cell injury	1	3
2.2. Disorders of peripheral circulation and microcirculation. Thrombosis. Embolism	-	9
2.3. Inflammation	3	6
2.4. Infectious process. Fever. Immunopathological processes	1	3
2.5. Typical metabolic disorders	-	6
2.6. Hypoxia. Extreme conditions of an organism	1	3
2.7. Tumor growth	2	6
3. Pathophysiology of organs and systems	9	48
3.1. Pathophysiology of blood system	-	24
3.2. Pathophysiology of cardiovascular system	3	9
3.3. Pathophysiology of external respiration	1	3
3.4. Pathophysiology of liver. Pathophysiology of digestive system	2	3
3.5. The pathophysiology of kidneys	1	3
3.6. Pathophysiology of endocrine system	1	3
3.7. Pathophysiology of nervous system. Pathophysiology of skin, connective tissue and joints	1	3
Total number of hours	20	99

CONTENT OF THE EDUCATIONAL MATERIAL

1. General nosology

1.1. Introduction to the subject «Pathological physiology». Subject, tasks and methods of Pathophysiology. General questions about the disease teachings. The doctrine of the etiology and pathogenesis

Pathological physiology as fundamental science and educational discipline. Subject and tasks of Pathophysiology: its place in the system of medical education, as the theoretical basis of modern clinical medicine. Value of pathophysiological researches for development of preventive health care, improvement and development of new methods and means of diagnosis and disease treatment.

Methods of pathological physiology. The value of experiment in the development of experimental and clinical medicine pathophysiology. General principles of biomedical experiments and their results' interpreting. Modern methods used in pathophysiological experiment. Modeling: its types, capabilities and limitations. Animal model of various forms of pathological processes and protective-adaptive reactions in man; value of comparative evolutionary method. Moral and ethical aspects of experiments on animal. Role of the newest advances in molecular biology, genetics, biophysics, biochemistry, electronics, mathematics, cybernetics, ecology and other sciences in the development of modern pathophysiology. The importance of the latest directions in modern medical and biological science (physiom, genome, proteome, transcriptom, metabolom, etc.) for the development of pathological physiology. Experimental therapy as an important method for the study of diseases and the development of new treatment methods.

Brief information on the history of Pathophysiology; main stages of its development. The role of Russian scientists in the development of pathological physiology.

Basic concepts of general nosology. Norm, health, transition of the body state between health and disease. The concept of the pathological response, the pathological process, pathological condition, disease. Typical pathological processes. A disease as a dialectical unity of damage and protective-adaptive (sanogenetic) reactions of organism; systemic principle in pathology; the integrity of the organism. Stage of the disease, its outcomes. Complete or incomplete recovery. Remission, relapse, complications, transition to a chronic form. Value of biological and social factors in human pathology. Principles of diseases classification. General principles of disease prevention and treatment; value of drug therapy and pharmacoprophylaxis.

The concept of etiology. The role of causes and conditions in the occurrence of diseases; their dialectical relationship. Correlation of biological and social factors in the etiology of human diseases. The concept of external and internal causes of disease. Properties of pathogenic factors; their main categories. Side effect of drugs as possible pathogenic factors.

The principle of etiotropic prevention and treatment of diseases. Pollution control of the environment, with drunkenness and alcoholism and with other harmful habits of health as the most important social aspect of the preventive focus of the modern healthcare system.

The definition of pathogenesis. Damage as a primary link in the pathogenesis. Injury levels: submolecular, molecular, subcellular, cellular, organ, tissue, organism. Manifestation of injury at different levels of the body. The unity of structural and functional changes in pathogenesis of diseases. The role and place of the etiological factor in the pathogenesis.

The cause-and-effect relations in the pathogenesis; primary and secondary damage. Localization and generalization of damage; local and general reactions to damage, their relationship. Leading links of pathogenesis and «vicious circles», trace reaction.

Protective-adaptive capabilities of a healthy and sick organism: protective reactions, compensatory and recovery processes. Their dialectical relationship with the processes of damage and the importance in the recovery of a sick organism.

Principle of pathogenetic therapy of diseases. Possibilities and main directions of pathogenetic pharmacotherapy.

1.2. Reactivity of the organism, its role in pathology. The role of heredity in pathology. Pathophysiology of an aging organism

The concept of reactivity and resistance of the body. Types of reactivity and the factors that determine it. The value of the organism's reactivity in the origin, flow and outcome of diseases. Pathological reactivity, its forms and causes; the possibility of formation of pathological reactivity under the influence of drugs. Dependence of the action of drugs on individual reactivity. Definition of the constitution of the body. Classification of constitutional types. The role of the constitution in the features of the emergence, development and outcome of disease.

Directed change in the reactivity of the organism as a way of preventing and treating diseases. Possibility of pharmacological action on reactivity.

The concept of hereditary and congenital diseases, phenocopies, monogenic and polygenic hereditary diseases.

Causes of hereditary pathology. Mutations and their varieties. Mutagenic factors. The importance of ionizing radiation and chemical pollution of the environment. Medicinal products as possible mutagens. The concept of epigenetic regulation of gene activity.

Mechanisms of formation of hereditary pathology. Types of transmission of genetic inherited diseases: autosomal dominant, autosomal recessive, codominant, mixed and sex-linked. Penetrence and expressiveness of hereditary diseases. Hereditary metabolic diseases. Chromosomal diseases. Hereditary predisposition to diseases. The importance of heredity in the development of multifactorial diseases.

Methods of hereditary pathology studying. General principles and social aspects of the prevention and treatment of hereditary diseases. Tasks of medico-genetic consultation. The concept of genetic engineering, prospects.

Pathology of intrauterine development. The concept of gametopathy, blastopathy, embryopathy and fetopathy. The meaning of critical periods in the development of the embryo and fetus. Medicines as the cause of the pathology of intrauterine development.

Pathophysiology of aging. The tasks of gerontology and geriatrics. Syndromes of premature aging. Possible effects that slow the aging process.

1.3. Pathogenic action of environment factors

Pathogenic effect on the body of low and high temperature of the environment: hypothermia and hyperthermia.

Kinetosis and overload. The nature and pathogenesis of changes in the body under the action of these factors.

The nature and pathogenesis of disturbances in the body under the influence of low and high atmospheric pressure, electric current, sound, noise, ultrasound, electromagnetic radiation and laser radiation.

Pathogenic effect on the body of chemical factors, alcohol and drugs. Medicines as pathogenic factors. Importance of abuse of medicines.

The role of psychogenic pathogenic factors in the emergence of human diseases.

Radiation injuries and radiation sickness. Mechanisms of the biological effect of ionizing radiation on the body. Acute and chronic forms of radiation sickness. Local and general manifestations of radiation sickness: changes in hemopoiesis and composition of peripheral blood; disorders of the endocrine and immune systems; disorders of the gastrointestinal tract, lesions of other organs and tissues. Remote effects of ionizing radiation. General principles of prevention and therapy of radiation injuries and radiation sickness. The main ways of pharmacotherapy of acute radiation sickness: anti-infective and detoxification therapy; elimination of hypohydration of the body; stabilization of biological membranes; stimulation of regenerative processes; symptomatic therapy.

2. TYPICAL PATHOLOGICAL PROCESSES

2.1. Cell injury

The causes of cell damage: the effects of physical, chemical and biological factors. Exogenous and endogenous pathogens that cause cell damage. Cell aging.

General mechanisms and the main manifestations of cell damage. Direct and indirect action of the damaging agent on the cell. Mechanisms of violation of energy generation in the cell. Violation of the regulation of free calcium in the cytosol of cells. Active forms of oxygen and nitrogen, the mechanisms of their formation. The concept of oxidative and nitrosylating stress, its main consequences. The main mechanisms and consequences of damage to cell membranes. The consequences of damage to cellular structures: nucleus, mitochondria, endoplasmic reticulum, peroxisome, Golgi complex. Mechanisms of protection and adaptation of cells in damaging effects. Microsomal detoxification system, buffer systems, antioxidant and antimutation systems, heat shock proteins, proteasome. Adaptive changes in the functional activity of the cell and its genetic apparatus. Reversible and irreversible cell damage. Violations of the structures and functions of damaged cells and processes of intercellular interaction.

Forms of cell adaptation to the action of pathogens: hypertrophy, hyperplasia, metaplasia, anaplasia, atrophy, dysplasia, dystrophy.

Apoptosis: definition of the concept; pathways of apoptosis; stage of apoptosis. The role of disturbance in the regulation of apoptosis in human pathology.

Autophagy: definition of the concept, its types and mechanisms. The importance of autophagy in physiological conditions and in various forms of pathology.

Necrosis and autolysis: definition of concepts, mechanisms of development and effect.

General principles of preventing and repairing cell damage. Ways of pharmacological therapy: increasing the adaptive properties of cells; decrease in their metabolic and functional activity; normalization of microcirculation, membrane-stabilizing effects; stimulation of reparative processes in damaged cellular structures.

2.2. Disorders of peripheral circulation and microcirculation. Thrombosis.

Embolism

The main forms of violations of the regional circulation: arterial hyperemia, venous hyperemia, ischemia, stasis. Their types, causes, mechanisms of development and external manifestations. Varicose veins, phlebitis, obliterating endarteritis. State of microcirculation, local tissue and general changes in the body with arterial and venous hyperemia, ischemia, stasis; their long-term consequences. Significance of collateral circulation. Principles of drug therapy of regional circulatory disorders.

Disturbances of microcirculation of blood, lymph and tissue fluid. Changes in the rheological properties of blood; the phenomenon of «sludge» and microthrombosis. Violations of the permeability of the vascular wall, the processes of filtration and resorption. Causes and mechanisms of microcirculatory disorders. The role of physiologically active substances in their origin. The concept of capillary-trophic insufficiency. Consequences of disorders of microcirculation and lymphodynamics. Principles of pharmacological therapy of microcirculatory disorders: normalization of rheological properties of blood and prevention of sludge; decrease in adhesive properties of the vascular wall; inhibition of platelet aggregation; decreased blood clotting; activation of thrombolysis mechanisms; decrease in permeability of vascular-tissue membranes, improvement of lymphatic drainage.

Thrombosis, definition of the concept. Conditions conducive to the onset of thrombosis (the Virchow triad): a disturbance of blood flow, damage (dysfunction) of endotheliocytes, an increase in the coagulation potential of the blood. Hereditary and acquired forms of increased propensity to thrombosis. Consequences of thrombosis. Embolism: causes, types of emboli, consequences. The concept of thromboembolic disease.

Principles of pharmacological prophylaxis and treatment of thrombosis and embolism: effects on the tone of the vascular wall; decrease in the activity of components of the blood coagulation system; stimulation of anticoagulant system (physiological anticoagulants); influence on the dynamic properties of platelets; thrombolysis.

2.3. Inflammation

Inflammation: a general characteristic, etiology, classification. Mechanisms of launching infectious (septic) and aseptic inflammation. Local and general manifestations of inflammation. Inflammation as a phasic (phase) process. The main phases of inflammation: alteration, vascular reactions with exudation, leukocyte emigration and phagocytosis, proliferation.

Acute inflammation. Alteration: species, meaning. Changes in local circulation and microcirculation in the inflammation focus, stages and mechanisms. Exudation: mechanisms, meaning. Types of exudates. Emigration of leukocytes, its mechanisms. The role of cell adhesion molecules for leukocytes and chemokines in the emigration of leukocytes. Phagocytosis and its significance. Mechanisms of phagocytosis. Violations of the activity of phagocytes. Proliferation, its mechanisms and significance.

Endogenous mechanisms controlling the course of inflammation.

Chronic inflammation: causes, mechanisms of development. The key role of macrophages in the development of chronic inflammation.

The main mediators of inflammation: species, origin, participation in the development of inflammation.

Systemic reactions in inflammation. Characteristics of proteins of the acute phase of inflammation. The concept of «systemic inflammation of low intensity.» Interrelation of damage and protective-adaptive reactions in the inflammatory process. The biological significance of inflammation. The concept of the wound process. Mechanisms of wound healing.

General principles of prevention and treatment of inflammation. The main principles of pharmacotherapy of inflammation: etiotropic and pathogenetic.

2.4. Infectious process. Fever. Immunopathological processes

Infectious process as a form of interaction of micro- and macroorganism. General mechanisms of anti-infective resistance of the body. Ways of introducing infectious agents into the body and their distribution. Stages of the infectious process; its outcomes and complications. The concept of sepsis, its etiology and pathogenesis.

Ways of preventing infectious diseases. Principles of pharmacological intervention in the infectious process: effects on the causative agents of infection, correction of the immune response; stimulation of nonspecific resistance mechanisms.

The concept of fever and its general characteristics. Etiology of febrile reactions. Infectious and non-infectious fever.

Exogenous and endogenous pyrogenic substances, their chemical nature and sources of formation in the infectious process, aseptic tissue damage in immune reactions. Changes in thermoregulation at different stages of fever, their mechanisms. The concept of the types of feverish reactions. Change in metabolism and physiological functions in fever. The biological significance of fever. Difference of fever from exogenous or endogenous hyperthermia; the concept of heat and sun impact.

Principles of antipyretic therapy. The concept of pyrotherapy. Methods of pharmacological induction of artificial fever.

Allergy: general characteristic, connection with the phenomena of immunity. Exogenous and endogenous allergens, their classification. Types of allergies; drug allergy. Ways, mechanisms and types of allergic sensitization of the body; Types of allergic antibodies involved in allergic reactions.

Type I, II, III and IV allergies. Causes and mechanisms of development. Mediators of allergic reactions of immediate type. Manifestation of anaphylaxis and atopy. Anaphylactic shock. Pollinosis, bronchial asthma, urticaria and angioedema. The concept of pseudoallergia. Serum sickness. Forms and mechanisms of delayed hypersensitivity development. Mediators of allergic reactions of delayed type. Manifestations of delayed type allergy. Bacterial allergy, contact dermatitis.

Reaction of graft rejection. «Transplant against the host» disease.

Autoimmune diseases. Violation of the mechanisms of immune tolerance as a cause of the development of autoimmune diseases. The significance of the state of histohematic barriers, microorganisms and the system of representing antigens in the development of autoimmune diseases. Mechanisms of tissue damage in autoimmune diseases.

Immunodeficiency conditions, their hereditary and acquired forms. Causes, mechanisms of formation and manifestation of immunodeficiency conditions. Possible occurrence of immunodeficiency conditions in human life conditions in areas contaminated with radionuclides. The role of chemical factors and drugs in the development of secondary immunodeficiencies.

Syndrome of acquired immune deficiency: etiology, pathogenesis, clinical manifestations.

General principles of prevention and treatment of allergies and autoimmune diseases.

2.5. Typical metabolic disorders

The main forms of water metabolism disorders are hypo- and hyperhydration. Types, causes, mechanisms of development, manifestations and consequences of hypo- and hyperhydration. The concept of edema. Types of edema. Pathogenetic factors of edema; the role of neuro-cardiovascular and renal mechanisms in the development of edema. Principles of prevention and treatment of hypo- and hyperhydration. Ways of pharmacotherapy of edema: an increase in the tone of venous vessels and a reduction in stagnant phenomena in tissues; increased diuresis; increased colloid osmotic blood pressure; decrease in permeability of vascular-tissue membranes.

Disorders of electrolyte metabolism. Changes in the content and ratio of the most important ions (sodium, potassium, calcium, magnesium) and trace elements in the intracellular and extracellular spaces of the body. Disorders of the distribution and exchange of electrolytes between the cellular and extracellular sectors. The main causes, mechanisms and consequences of electrolyte balance disorders. Pharmacotherapy of electrolyte metabolism disorders by affecting various elements of electrolyte exchange regulation systems: the receptor apparatus, the neuroendocrine link, the excretory organs; substitution therapy.

Violations of acid-base balance. Forms of violations of the acid-base balance of the internal environment of the body. Gas acidosis and alkalosis. Negative (metabolic) acidosis and alkalosis. Mixed forms. Compensatory reactions for violations of acid-base balance. Disorders of body functions that occur with various types of acidosis and alkalosis. Principles of treatment of acid-base balance disorders in the body: effects on components of blood buffer systems; change of physiological mechanisms of regulation of acid-base homeostasis.

Violations of carbohydrate metabolism. Disorder of absorption of carbohydrates in the intestine, synthesis, deposition and cleavage of glycogen, transport of carbohydrates into the cell and their assimilation. Hypoglycemic conditions, their causes, mechanisms and manifestations; hypoglycemic coma. Hyperglycemic conditions, their causes and mechanisms. Diabetes mellitus: classification, etiology, pathogenesis, basic manifestations. Disorders of metabolism and body functions in diabetes mellitus. Pathogenesis of coma in diabetes mellitus. General principles of prevention and treatment of carbohydrate metabolism disorders: normalization of endocrine mechanisms; normalization of blood glucose; hormone replacement therapy.

Disorders of lipid metabolism. Hyperlipidemia, its types. General obesity, its types, mechanism of development and consequences. Cholesterol metabolism disorders. Hypercholesterolemia. The concept of atherosclerosis. The role of violations of lipid metabolism and changes in the properties of the vascular wall in the development of atherosclerosis. Pathogenesis of metabolic syndrome. General principles of prevention and treatment of lipid metabolism disorders. Anti-atherosclerotic measures: diet and vitamin therapy; normalization of the level of lipoproteins and cholesterol in the blood plasma; inhibition of cholesterol synthesis.

Violations of protein metabolism. Disturbance in the assimilation of food proteins. Positive and negative nitrogen balance. The concept of alimentary dystrophy. Disorders of the intermediate metabolism of individual amino acids and the amino acid composition of the blood. Changes in the protein composition of blood plasma; hyper-, hypo- and disproteinemia. Disorders of the final stages of protein metabolism; urea synthesis disorders. Hyperazotemia, its types. Gout and its types.

Violations of the exchange of vitamins. Hyper-, hypo-, dis- and avitaminosis. The causes and main mechanisms of metabolic disorders of vitamins. Exogenous and endogenous hypovitaminosis; the role of antivitamins in their origin. Characteristic manifestations of the most important forms of hyper- and hypovitaminosis. Principles of prevention and treatment of vitamin exchange disorders. General ways of treatment of vitamin exchange disorders: effects on the absorption, storage, utilization and metabolism of vitamins, substitution therapy.

2.6. Hypoxia. Extreme conditions of an organism.

Definition of the concept, a general characteristic of hypoxia as a state of absolute or relative insufficiency of biological oxidation. Stability of individual organs and tissues to oxygen starvation. Principles of classification of hypoxic conditions. Types of hypoxia. Etiology and pathogenesis of the main types of

hypoxia: exogenous, respiratory, circulatory, hemic, tissue. Hypoxia due to relative insufficiency of biological oxidation with excessive physical exertion and with dissociation of oxidation and phosphorylation. Mixed types of hypoxia.

Disorders of metabolism and physiological functions in acute and chronic hypoxia. Emergency and long-term adaptation to hypoxia.

General principles of prevention and therapy of hypoxic conditions. Use of hyperbaric oxygenation in the prevention and treatment of severe forms of hypoxia. Ways of pharmacotherapy of hypoxic conditions: increasing the body's resistance to hypoxia by reducing the overall level of functional activity of the body and energy consumption; prospects for specific interference in the process of biological oxidation with the help of antihypoxants of different mechanism of action.

The concept of stress as a general and local adaptation syndrome and as a nonspecific reaction of the organism to various extreme effects. The concept of allostasis, homeostasis and allostatic load as dynamic characteristics of stress. Stages, mechanisms of development and manifestations of stress. Protective-adaptive and pathogenic importance of stress.

Principles of prevention and correction of stress reactions of the body. Ways of pharmacological interventions: effects on neurogenic, catecholamine and corticosteroid mechanisms of stress; correction of anti-stress mechanisms; normalization of disturbed physiological functions.

Fainting (syncope): definition of the concept, causes, mechanisms of occurrence, types of fainting.

Shock. Definition of the concept. Types of shock. Hypovolemic shock: etiology. Character and mechanism of disturbance of systemic hemodynamics and microcirculation in hypovolemic shock. The concept of obstructive shock.

Cardiogenic shock: the causes, character and mechanisms of disturbance of systemic hemodynamics and microcirculation.

Distributive (vasogenic) shock. Types of distribution shock. Causes, the nature and mechanisms of systemic hemodynamics and microcirculation disorders in distributive shock. Pathogenesis of septic shock.

The nature and pathogenesis of metabolic disorders in shock. Stages of shock development, their characteristics.

Concept of Crush syndrome: etiology, pathogenesis, manifestations, consequences.

General principles of the prevention of shock and antishock therapy. Ways of pharmacocorrection: anesthesia, normalization of blood volume; detoxification therapy; correction of acid-base and water-electrolyte balance; antihypoxic therapy; normalization of external respiration, cardiac activity, vascular tone, microcirculation, kidney and liver function.

Collapse. Characteristics of the concept; similarity and difference of collapse and shock. Types of collapse: posthemorrhagic (hypovolemic), vascular, cardiogenic. Principles of pathogenetic therapy of collapse.

Coma. General characteristics of coma. The importance of exogenous and endogenous intoxications in their origin; alcohol and drug poisoning as the cause of

coma. Diabetic, hypoglycemic, uremic and hepatic coma. Stages of development, common and specific for different types of coma pathogenetic mechanisms; the main manifestations of coma.

Terminal states: definition of the concept, their types. Functional and metabolic changes in terminal states. Principles and methods of restoration of vital functions of an organism at terminal states. The nature and mechanism of disorders in the body in terminal states. Pathogenesis of postresuscitative disorders.

General principles of their prevention and treatment. The main ways of pharmacocorrection: binding and elimination of toxic compounds; correction of acid-base and electrolyte balance; Dehydration therapy for edema of the brain and lungs; elimination of hypoxia and hypo- or hyperglycemia; antibacterial therapy.

2.7. Tumor growth

Tumor growth. Etiology of the origin of tumors (physical, chemical and biological carcinogens). Comparative characteristics of malignant and benign tumors; principles of their classification. General properties of tumor cells.

The role and place of proto-oncogenes; suppressor genes; genes that control apoptosis and genes that control DNA repair in neoplasia. The significance of checkpoints violations of cell mitotic cycle in the pathogenesis of tumors. Telomeres and telomerase in tumor cells. Biological features of neoplasia. Stages of the tumor process: transformation, progression, invasion and metastasis. Mechanisms of malignant tumor metastasis. Antitumor resistance of the body: immune and non-immune factors of antitumor resistance.

Interaction of tumor and an organism. Paraneoplastic syndromes. Tumor cachexia.

Pathogenetic principles of prevention and therapy of tumor transformation and neoplasia. General principles of surgical treatment, chemo-, radio- and immunotherapy of a malignant tumor.

3. PATHOPHYSIOLOGY OF ORGANS AND SYSTEMS

3.1. Pathophysiology of blood system

Violations of the volume of circulating blood and their types. The nature and mechanism of pathological and adaptive reactions after acute and chronic hemorrhage.

Pathophysiology of erythron. The concept of anemia. Etiology, pathogenesis, principles of classification and the main hematological manifestations of anemia. The importance of the drug factor in the origin of certain types of anemia. Disorders in the body with anemia. Acute and chronic posthemorrhagic anemia: causes, mechanisms of development, manifestations. Hereditary and acquired hemolytic anemia: etiology, pathogenesis, clinical manifestations. Iron deficiency, iron-refractory, vitamin B12-deficient and folio-deficient anemia. Anemia in chronic diseases (chronic inflammation). Acquired and hereditary hypo- and aplastic anemia: etiology, pathogenesis, manifestations, consequences. General principles of the prevention and treatment of anemia. The main ways of drug therapy for various forms of anemia. Erythrocytosis, definition of the concept, types and mechanisms of occurrence.

Pathophysiology of the leukocyte system (leukon). Leukocytosis and leukopenia, causes, types and mechanisms of occurrence. Changes in the leukocyte formula. Violations of the functional properties of leukocytes (phagocytic capacity, etc.).

Hemoblastosis, their etiology and classification: hematosarcoma and leukemia (leukemia). Etiology of hemoblastosis. Features of hematopoiesis and cellular composition of peripheral blood in leukemia. Acute lymphoblastic and myeloblastic leukemia: species, manifestations. Chronic lymphoproliferative and myeloproliferative diseases: species, manifestations. Pathogenesis of hemoblastoses. The main syndromes in hemoblastosis. Principles of prevention and treatment of hemoblastoses; tasks and possibilities of chemo-, radio- and immunotherapy.

Pathophysiology of the leukocyte system (leukon). Leukocytosis and leukopenia, causes, types and mechanisms of occurrence. Changes in the leukocyte formula. Violations of the functional properties of leukocytes (phagocytic capacity, etc.).

Hemoblastosis, their etiology and classification: hematosarcoma and leukemia (leukemia). Etiology of hemoblastosis. Features of hematopoiesis and cellular composition of peripheral blood in leukemia. Acute lymphoblastic and myeloblastic leukemia: species, manifestations. Chronic lymphoproliferative and myeloproliferative diseases: species, manifestations. Pathogenesis of hemoblastoses. The main syndromes in hemoblastosis. Principles of prevention and treatment of hemoblastosis; purpose and possibilities of chemo-, radio- and immunotherapy.

The concept of leukemoid reactions; its difference from leukemia.

Syndrome of increased hemorrhage (hemorrhagic syndrome), the concept of thrombohemorrhagic syndrome (DVS-syndrome). Thrombocytopenia: etiology, pathogenesis, manifestations, consequences for the body. Thrombocytopathy: definition of the concept, types of thrombocytopathy. Hemorrhagic syndrome caused by the vascular wall pathology: hemorrhagic vasculitis (Schönlein's disease), hemorrhagic angiomatosis (Rundu-Osler's disease), scurvy: etiology, pathogenesis and manifestations. Hemorrhagic syndrome caused by a clotting disorder. Hemophilia A, B, C. Their characteristics. Hemophilia-like diseases and syndromes. The concept of hypercoagulable and thrombotic syndromes. The phenomenon of thrombophilia. DIC-syndrome: definition of the concept, the causes, the stages, the character of blood clotting disorders. The nature and pathogenesis of hemostasis changes at disturbances of the plasminogen-plasmin system function. General principles of drug therapy of hemorrhagic syndromes and thrombophilic syndromes.

3.2. Pathophysiology of cardiovascular system

General characteristics of the main types, causes and mechanisms of cardiovascular disorders. The social significance of cardiovascular diseases and the achievement of a modern health system in the fight against cardiovascular diseases.

Insufficiency of blood circulation and cardiac insufficiency: definition of concepts; types, causes. Classification of heart failure. Pathophysiological characteristic of heart failure. Dysfunction of the heart and systemic hemodynamics in acute heart failure. The syndrome of cardiac asthma. Consequences of inadequate

blood circulation in organs and tissues in acute heart failure. Compensatory reactions in cardiac heart failure. The concept of compensatory hyperfunction of the heart. The concept of heart remodeling. Etiology and pathogenesis of chronic heart failure: the role of the sympathetic nervous system; role of the renin-angiotensin-aldosterone system; the role of natriuretic peptides; violation of the «circulation» of calcium in cardiomyocytes; the role of proinflammatory cytokines; Change in gene expression in cardiomyocytes. Infringements in an organism at a chronic heart failure.

Functional and structural changes in the heart with its vices. Change in the activity of the cardiovascular system in diseases of the external respiration system. Syndrome «pulmonary heart».

Insufficiency of blood circulation, its main forms and manifestations. General principles of the prevention and treatment of heart disease.

Atherosclerosis as the main manifestation of arteriosclerosis. Morphological types of atherosclerotic vascular lesions. Risk factors for atherosclerosis, their classification. The main complications of atherosclerosis. Etiology and pathogenesis of atherosclerosis.

Ischemic heart disease (IHD): classification, causes, mechanisms of myocardial damage. The concept of stunned myocardium and hibernating myocardium. Reperfusion injury of the myocardium. Myocardial infarction. Causes of its occurrence. Pathogenesis of transmural and subendocardial myocardial infarction. The phenomenon of electrical instability of the myocardium. General principles of prevention and treatment of coronary heart disease.

Arrhythmias of the heart. Their types, causes and mechanisms of occurrence. The nature of changes in cardiac activity in arrhythmias of the heart. General principles of the prevention and treatment of arrhythmias.

Disorders of vascular tone regulation: arterial hypertension and hypotension. Classification of arterial hypertension. Primary arterial hypertension (essential hypertension, essential hypertension) and secondary (symptomatic) arterial hypertension. Their etiology and pathogenesis. Complications and consequences of hypertension. The nature and pathogenesis of damage to target organs (heart, kidney, brain) with arterial hypertension. General principles of prevention and treatment of hypertension.

Acute and chronic arterial hypotension. Their causes, mechanisms of development and consequences. The concept of hypotonic disease. General principles of prevention and treatment of arterial hypotension.

3.3. Pathophysiology of external respiration

Respiratory failure and its types. Types of disturbances in the gas exchange function of the external respiration system: alveolar hyper and hypoventilation, violation of effective pulmonary blood flow, local uneven ventilation-perfusion relations, difficulty in alveolar-capillary diffusion. Causes and mechanisms of their occurrence, consequences. Obstructive type of damage to the external respiration system: its characteristics, causes. Restrictive type of defeat of the external respiration system. Causes of appearance, manifestations.

General signs of violations of the external respiration system: shortness of breath, stenotic breathing, cough, disturbance of respiratory rhythmogenesis, apnea. The phenomenon of asphyxia, its pathophysiological characteristics. The main forms of pathology of respiratory organs: pleurisy, pneumonia, bronchitis, bronchiectatic disease; pneumoconiosis; emphysema of the lungs; cancer of the bronchi and lungs; pneumo-, hydro- and hemothorax. Cardiogenic and noncardiogenic pulmonary edema. Syndrome of acute respiratory distress: etiology, pathogenesis, clinical manifestations. Syndrome of respiratory distress of newborns.

General principles of prevention and treatment of various forms of pathology of the external respiration system.

3.4. Pathophysiology of liver. Pathophysiology of digestive system

General characteristics of the causes and mechanisms of liver function disorders. Parenchymal, hepatobiliary and vascular lesions of the liver. Jaundice as a common symptom of liver pathology, its types and pathogenesis. Hereditary forms of bilirubin metabolism disorders. Hemolysis and cholestasis: definition of concepts, causes and effects. Functional liver failure. The hepatic coma. Hepatorenal and hepatorenal syndromes. Hepatic encephalopathy. Metabolic disorders in the body with hepatic insufficiency. The main forms of liver pathology: hepatitis, hepatosis, cirrhosis, tumors, parasitic liver disease; dyskinesia of the biliary tract, cholecystitis, cholelithiasis. Portal hypertension: its types, causes, manifestations. Medicinal lesions of the liver. Ways of prevention and treatment of major diseases of the liver and biliary tract.

General characteristics of the causes and mechanisms of digestive system disorders. An upset of appetite. Hypo- and hypersalivation. Diseases of the oral cavity, dentoalveolar apparatus and pharynx. The concept of dysphagia and the pathology of the esophagus.

Pathology of the stomach: the main causes and mechanisms of its occurrence. Violations of the secretory and motor functions of the stomach, their types; changes in the composition of gastric juice. The causes, mechanisms and consequences of these violations. Gastritis, peptic ulcer of stomach and duodenum, stomach cancer. The role of *Helicobacter pylori* infection in the pathology of the stomach and duodenum. Disease of the operated stomach; dumping syndrome.

Pathology of the pancreas: acute and chronic pancreatitis, their etiology and pathogenesis. Pancreas cancer.

Pathology of the small and large intestine. Disturbances of motor function; the concept of dynamic and mechanical intestinal obstruction; constipation, diarrhea. Disorders of near-wall (membrane) digestion. The concept of maldigestia and malabsorption. The main consequences of digestive failure. Enteritis, colitis, appendicitis, intestinal autointoxication, intestinal tumors. Pathophysiological consequences of intestinal microbioma. The main diseases of the colon: irritable bowel syndrome, colitis, Crohn's disease, ulcerative colitis, tumor and vascular lesions of the large intestine. General principles of prevention and treatment of the digestive system diseases.

3.5. The pathophysiology of kidneys

General characteristics of the causes and mechanisms of renal dysfunction. Disorders of renal hemodynamics; difficulty urinating outflow; lesions of the renal parenchyma; disorders of neuro-humoral regulation of urination. Medicinal lesions of the kidneys. The main manifestations of disorders of renal function, changes in diuresis and urine composition; dysuric phenomena. Quantitative changes in diuresis: their types, etiology and pathogenesis. Qualitative changes in the composition of urine: their types, etiology, pathogenesis, consequences. Nephrotic syndrome: definition of the concept, the causes and mechanisms of its occurrence, the nature of changes in the body.

The concept of acute and chronic renal failure; mechanisms for their development and manifestation. Uremia; uremic (renal) coma, its pathogenesis. The main forms of pathology of the kidneys and urinary tract: glomerulonephritis, pyelonephritis, tubulopathy, urolithiasis, pyelitis, cystitis, urethritis.

General principles of prevention and treatment of kidney and urinary tract diseases. Drug therapy ways of urinary function disorders.

3.6. Pathophysiology of endocrine system

General characteristics of the causes and mechanisms of endocrine disorders. Violations of the central (cortico-hypothalamic-pituitary) regulation of the endocrine glands. Primary disruption of the formation of hormones in the endocrine glands. Peripheral (extragranular) forms of endocrine disorders. The main forms of endocrinopathies: hypo-, hyper- and dysfunction; partial and total disorders, mono- and polyglandular disorders; ontogenetic early and late endocrinopathies.

Pathology of the hypothalamic-pituitary system. Hypo- and hyperfunction of the anterior and posterior lobe of the pituitary gland. Pituitary dwarfism, diabetes insipidus; pituitary cachexia. Gigantism, acromegaly, Itenko-Cushing's disease. Pathology of the adrenal glands. Acute and chronic insufficiency of the adrenal cortex. Addison's disease. Hyperfunction of the cortical and medulla of the adrenal glands; adrenogenital syndrome, pheochromocytoma. The concept of hyper- and hypoaldosteronism.

Pathology of the thyroid gland. Hypo- and hyperthyroidism. Myxedema, endemic goiter, endemic cretinism; Basedova's disease, adenoma and thyroid cancer.

Pathology of parathyroid glands. Hypo- and hyperparathyrosis.

Pathology of the gonads. Hypo- and hypergonadism in women and men. Infantilism, eunuchoidism; premature puberty.

The main ways of prevention and treatment of endocrine diseases.

3.7. Pathophysiology of nervous system. Pathophysiology of skin, connective tissue and joints

General characteristics of the causes and mechanisms of the nervous system disorders. The role of social factors in the occurrence of disorders of nervous activity, the importance of domestic intoxication; The possibility of the medicinal origin of these disorders. Inflammatory, vascular, neurodegenerative, posttraumatic and neoplastic diseases of the nervous system.

Neurogenic movement disorders. Hypo- and hyperkinetic states. Central and peripheral paralysis and paresis. Extraparamidal disorders. Ataxia, parkinsonism, convulsive syndrome. The concept of myasthenia gravis and epilepsy.

Neurogenic sensitivity disorders. Types of sensory disorders. Pain, its mechanisms and biological significance. The concept of migraine, neuralgia, thalamic and phantom pain.

Neurogenic vegetative disorders, their types and basic manifestations. The concept of vegetative dystonia. Neurogenic trophic disorders: neurogenic atrophies and dystrophy.

Violations of higher nervous activity. General ideas about mental disorders and behavioral disorders. Functional disorders of higher nervous activity (neurotic disorders, neurasthenia, hysteria, psychopathy, psychosis, oligophrenia, dementia, schizophrenia). Social aspects of nervous and mental diseases.

Ways of preventing and treating diseases of the nervous system.

General manifestations of skin diseases of non-tumor and tumor nature, infectious etiology; hereditary and congenital skin diseases.

Damage to connective tissue and joints in rheumatism and rheumatoid diseases.

General principles of prevention and treatment of diseases of the skin, connective tissue and joints.

EDUCATIONAL DISCIPLINE CURRICULAR CHART

Section, topic #	Section (topic) name	Number of class hours		Self-studies	Equipment	Form of control
		lectures	practical (laboratory or seminars)			
1	2	3	4	5	7	8
	6 semester					
1. General nosology		3	15	18		
1.1.	Introduction. General questions about the studies of the disease. The doctrine of the etiology and pathogenesis	1	3	3	1.1; A1-A3	1.2; 4.1.
1.2.	Reactivity of the organism its role in pathology. The role of heredity in pathology. Pathophysiology of an aging organism	2	6	10	2.1-2.3; A4-A6	1.1; 1.2; 2.1; 2.2; 4.1.
1.3.	Influence of pathogenic environmental factors	-	6	5	3.1-3.4; A7-A8	1.1; 1.2; 2.1; 4.1.
2. Typical pathological processes		8	36	28		
2.1.	Pathophysiology of cell	1	3	4	4.1-4.5; A9	1.1; 1.2; 2.1; 4.1.
2.2.	Disorders of peripheral circulation and microcirculation. Thrombosis, embolism	-	9	6	5.1-5.4; A10	1.1; 1.2; 2.1; 4.1.
2.3.	Inflammation	3	6	4	6.1-6.9; A11-A12	1.1; 1.2; 2.1; 4.1.
2.4.	Infection Process. Fever. Pathophysiology of immune system	1	3	4	A13	1.1; 1.2; 2.1; 4.1.
2.5.	Typical metabolic disorders	-	6	3	7.1-7.9; A14-A15	1.1; 1.2; 2.1; 4.1.
2.6.	Hypoxia. Extreme conditions	1	3	3	8.1-8.4; A16	1.1; 1.2; 2.2; 4.1.
2.7.	Tumor growth	2	6	4	9.1-9.8; A17-A18	1.1; 1.2; 2.1; 4.1.

		7 semester				
3.	Pathophysiology of organs and systems	9	48	87		
3.1.	Pathophysiology of blood system	-	24	42		
	Pathology of the erythron. Pathological forms of erythrocytes and hemoglobin	-	3	4	A19	1.1; 2.2; 4.1.
	Anemia and erythrocytosis	-	6	6	10.1-10.4; A20	1.1; 2.1; 4.1.
	The pathology of the leukon. Pathological forms of leukocytes. Leukocytosis and leukopenia	-	3	8	A21	1.1; 2.2; 4.1.
	Hemoblastosis. Leukemia	-	6	6	A22	1.1; 2.2; 4.1.
	Changes in total blood volume	-	3	5		1.1; 1.2; 2.2; 4.1.
	Hemostasis system disorders	-	3	5	A23-A24;	1.1; 2.1; 4.1
	Final lesson on the topic «Pathophysiology of the blood system»	-	3	8	10.1-10.4; A19-A24	1.1; 1.2; 1.3; 2.1; 2.2; 4.1.
3.2.	Pathophysiology of the circulatory system	3	9	22		
	Heart failure.		3	6	A25	1.1; 1.2; 2.1; 4.1.
	Heart rhythm disturbances.	2	3	6	11.1-11.3; A26	1.1; 2.3; 4.1.
	Disorders of vascular tone.		3	4	12.1-12.3; A27	1.1; 1.2; 2.1; 4.1.
	Final lesson on the topic «Pathophysiology of the cardiovascular system».	-	3	6	11.1-11.3; 12.1-12.3; A25-A27	1.1; 2.3; 4.1.
3.3.	Pathophysiology of external respiration system.	1	3	4	13.1-13.7; A28	1.1; 2.1; 4.1.
3.4.	Pathophysiology of liver Pathophysiology of digestive system.	2	3	5	14.1-14.3; A29, A30	1.1; 2.1; 4.1.
3.5.	Pathophysiology of kidneys.	1	3	4	15.1-15.5; A31	1.1; 2.1; 2.2; 4.1.
3.6.	Pathophysiology of endocrine system.	1	3	5	16.1-16.11; A32	1.1; 2.1; 4.1.
3.7.	Pathophysiology of nervous system. Pathophysiology of skin, connective tissue, joints.	1	3	5	17.1-17.9; A33	1.1; 2.1; 4.1.
Total hours		20	99	133		

INFORMATION AND INSTRUCTIONAL UNIT

LITERATURE

Basic:

Text books:

1. General and clinical pathophysiology / Kubyshkin A.V. // Vinnytsia: Nova Knyha Publishers – 2011. - 656 с.
2. «Pathophysiology: Concise Lectures, tests, clinic-pathophysiological situations and clinic-laboratory problems». - 2012. - 432 p. П.Ф.Литвицкий, С.В.Пирожков, Е.Б.Тезиков. Издательство : ГЭОТАР-Медиа. Москва;
3. Pathophysiology / N.K.Simeonova; ed. V.A.Mikhnev // 2-nd revised ed. - Kyiv : Medicine, 2015. - 544 p.
4. «Pathophysiology: textbook / N.V.Krishtal, V.A.Mikhnev, N.N.Zayko et al.; edited by N.V.Krishtal, V.A.Mikhnev. Kiev: AUS Medicine Publishing - 2017. – 656 p.

Teaching manuals:

5. Сборник ситуационных задач для самоконтроля полученных знаний на английском языке – Pathological physiology=Патологическая физиология: сб. ситуац. задач и доп. инф. к практ. занятиям / Ф.И.Висмонт [и др.]: пер. на англ. яз. Т.Ф.Данилова, С.А.Жадан. - Минск: БГМУ, 2010;
6. Учебно-методическое пособие - Патологическая физиология системы крови = Pathological physiology of the blood system : учеб. метод пособие / Е.В.Леонова [и др.] ; пер. на англ. яз. Т.Ф.Данилова, С.А.Жадан. – Минск: БГМУ, 2010. – 64 с.
7. Учебно-методическое пособие – Роль наследственности в патологии = The Role of the Heredity in Pathology: учеб.метод пособие / С.А.Жадан [и др.] ; – Минск: БГМУ, 2014. – 33с.
8. Учебно-методическое пособие – Повреждающее действие электрического тока (патофизиологические аспекты = Electric Current Injury (Pathophysiological aspects): учеб. метод. пособие / Д.М.Попутников [и др.] ; – Минск: БГМУ, 2014. – 23с.
9. Учебно-методическое пособие – Гипоксия (патофизиологические аспекты)=Hypoxia (pathophysiological aspects): учеб.-метод. пособие Е.В.Меленчук, С.А.Жадан, Ф.И.Висмонт; – Минск: БГМУ, 2015. – 23с.
10. Учебно-методическое пособие – Воспаление (патофизиологические аспекты)=Inflammation (pathophysiological aspects): учеб.-метод. пособие С.А.Жадан, Е.В.Меленчук, Ф.И.Висмонт; – Минск: БГМУ, 2015. – 35с.
11. Учебно-методическое пособие – Повреждающее действие ионизирующей радиации (патофизиологические аспекты)=Damagine Effects Of Ionizing Radiation (pathophysiological aspects): учеб.-метод. пособие С.А.Жадан, Е.В.Меленчук, Ф.И.Висмонт; – Минск: БГМУ, 2016. – 28с.
12. Учебно-методическое пособие – Повреждение клетки (патофизиологические аспекты)=Cell Injury (pathophysiological aspects): учеб.-

метод. пособие Е.В.Меленчук., С.А.Жадан, Ф.И.Висмонт; – Минск: БГМУ, 2016. – 24с.

13. Учебно-методическое пособие – Нарушения водно-электролитного обмена (патофизиологические аспекты)=Water and Electrolyte Balance Disorders (pathophysiological aspects): учеб.-метод. пособие Е.В.Меленчук., С.А.Жадан, Ф.И.Висмонт; – Минск: БГМУ, 2016. – 24с.

14. Учебно-методическое пособие – Патологическая физиология печени=Pathological Physiology of Liver : учеб.-метод. пособие / С.А.Жадан, Ф.И.Висмонт. – Минск: БГМУ, 2018. – 33с.

Additional:

15. Atlas of Pathophysiology (Hardcover) by Springhouse (Editor) (Hardcover, - 3-rd edition, 2009);

16. Basic Pathology / Kumar V., Abbas A., Aster J. Robbins // 9th Edition. Saunders, 2012. — 928 p.

LIST OF VISUAL AIDS

TRAINING VIDEOS:

1. ***Introduction. General questions about the studies of the disease. The doctrine of the etiology and pathogenesis***
 - 1.1. Animal Welfare. Foundation.
2. ***Reactivity of the organism its role in pathology. The role of heredity in pathology. Pathophysiology of an aging organism.***
 - 2.1. Progeria.
 - 2.2. Hypermobility of Skin & Joints.
 - 2.3. Ichthyosis.
3. ***Influence of pathogenic environmental factors***
 - 3.1. Electrical Arc.
 - 3.2. Lightning Strike.
 - 3.3. Burns Electrical.
 - 3.4. Radiation Effects on Humans.
4. ***Pathophysiology of cell***
 - 4.1. Causes of Cell Injury.
 - 4.2. Necrosis VS apoptosis.
 - 4.3. Apoptosis. Part 1.
 - 4.4. Apoptosis. Part 2.
 - 4.5. Morphological Expressions of Cell Injury.
5. ***Disorders of peripheral circulation and microcirculation. Thrombosis, embolism***
 - 5.1. Principle of Bulk Flow and Transcapillary Exchange.
 - 5.2. Capillary Fluid Exchange.

- 5.3. Deep Vein Thrombosis and Pulmonary Embolism.
- 5.4. Microcirculation.

6. Inflammation

- 6.1. Inflammation.
- 6.2. Acute Inflammation.
- 6.3. Cellular Response to Inflammation.
- 6.4. Complement System Ending. Opsonization and Membrane Attack Complex.
- 6.5. Leukocyte Extravasation.
- 6.6. Neutrophil Adhesion, Migration and Phagocytosis.
- 6.7. Leukocyte Rolling.
- 6.8. Phagocytosis.
- 6.9. The Process of Phagocytosis.

7. Typical metabolic disorders

- 7.1. Acidosis and Alkalosis.
- 7.2. Metabolic Acidosis.
- 7.3. Compensation of Respiratory and Metabolic Acidosis and Alkalosis.
- 7.4. Mixed Acid-Base Disorders with Normal pH.
- 7.5. Acid Base Balance.
- 7.6. Causes of Edema.
- 7.7. Edema. Part 1.
- 7.8. Edema. Part 1.
- 7.9. Edema. Part 2.

8. Hypoxia. Extreme conditions

- 8.1. Hypoxia.
- 8.2. Simulation Hypoxia in Experiment.
- 8.3. Simulation Lung Edema in Experiment.
- 8.4. Danilevsky's Experiment.

9. Tumor growth

- 9.1. Cancer - from a healthy cell to a cancer cell.
- 9.2. Immune System - Natural Killer Cell - The Formulation.
- 9.3. Introduction to Cancer Biology (Part 1). Abnormal Signal Transduction.
- 9.4. Introduction to Cancer Biology (Part 2). Loss of Apoptosis.
- 9.5. Introduction to Cancer Biology (Part 3). Tissue Invasion and Metastasis.
- 9.6. Introduction to Cancer Biology (Part 4). Angiogenesis.
- 9.7. Angiogenesis - How Cancer Grows and Spreads.
- 9.8. Cancer Growth Animation.

10. Pathology of the erythron. Pathological forms of erythrocytes and hemoglobin

- 10.1. Iron deficiency anemia.
- 10.2. What You Need to Know About B₁₂.
- 10.3. Beta Thalassemia.
- 10.4. Sickle Cell Anemia.

11. Pathophysiology of circulatory system. Heart rhythm disturbances

- 11.1. Introduction to Rhythm Interpretation. Part 1.
- 11.2. Introduction to Rhythm Interpretation. Part 2.
- 11.3. Introduction to Rhythm Interpretation. Part 3.

12. Pathophysiology of circulatory system. Disorders of vascular tone.

- 12.1. Diseases and Symptoms - What is Hypertension. 3D Medical Animations.
- 12.2. Major Effects of High Blood Pressure. 3D Medical Animation.
- 12.3. Biology of atherosclerosis progression.

13. Pathophysiology of external respiration system

- 13.1. Acute Respiratory Distress Syndrome (ARDS).
- 13.2. Adult Respiratory Distress Syndrome.
- 13.3. Infant Respiratory Distress Syndrome.
- 13.4. Cheyne-Stokes Respiration.
- 13.5. Kussmaul Breathing (Diabetic Ketoacidosis).
- 13.6. Lung Injury.
- 13.7. Pulmonary Edema-Negative Pressure.

14. Pathophysiology of liver Pathophysiology of digestive system.

- 14.1. Bilirubin Pathway.
- 14.2. Bilirubin Metabolism and Diseases.
- 14.3. Endoscopy. Gastric ulcers.

15. Pathophysiology of kidneys.

- 15.1. Nephron Function.
- 15.2. Urine Formation.
- 15.3. Renin Aldosterone Angiotensin System.
- 15.4. The End Stage of Renal Disease.
- 15.5. Kidney. Glomerulonephritis.

16. Pathophysiology of endocrine system.

- 16.1. The Endocrine System.
- 16.2. Disease & Conditions of Endocrine System.
- 16.3. Endocrine System, Pancreas.
- 16.4. Diabetes Symptoms.
- 16.5. How does Insulin work.
- 16.6. How type 2 Diabetes Develops.
- 16.7. Type 2 Diabetes.
- 16.8. Hypothyroidism – What is it? Causes. Symptoms.
- 16.9. Diabetes Effects on Body.
- 16.10. Hypoparathyroidism.
- 16.11. Parathyroid Glands and Hyperparathyroidism.

17. Pathophysiology of nervous system. Pathophysiology of skin, connective tissue, joints.

- 17.1. Neurons. Structure and Functions.

- 17.2. Spinal Cord Injury – Complete or Incomplete.
- 17.3. Tremor Disorder or Parkinson's.
- 17.4. Chorea.
- 17.5. Athetosis.
- 17.6. Myoclonus Dystonia.
- 17.7. Tics.
- 17.8. Mechanism of pain.
- 17.9. Phases of Nociceptive Pain.

A. COMPUTER PRESENTATIONS:

1. The Subject and Tasks of Pathological Physiology. Modeling of Diseases in Experiment.
2. General Etiology and Pathogenesis.
3. Actual Questions of Nosology.
4. Reactivity of Organism and Its Role in Pathology.
5. The Role of Heredity in Pathology.
6. Basic Hereditary Diseases and Syndromes.
7. The Influence of Electric Injury on the Body.
8. Action of Ionizing Radiation on the Body.
9. Cell Injury.
10. Peripheral Circulatory Disorders. Arterial and Venous Hyperemia. Thrombosis, Embolism, Ischemia. Typical Microcirculatory Disorders (Classification, Etiology, Pathogenesis, Manifestations and Outcomes).
11. Inflammation. Impairments of Blood Circulation at Inflammation.
12. Inflammation. Phagocytosis.
13. Pathological Physiology of Thermoregulation. Fever.
14. Disturbance of Acid-Base Status.
15. Pathological Physiology of Water Metabolism. Edema.
16. Hypoxia.
17. Basic Biological Features of Tumors. Etiology of Tumors.
18. The Pathogenesis of Tumors. The Relationship of Tumor with Organism. Principles of Tumor Treatment and Prophylaxis
19. Hematopoiesis.
20. Anemia. Erythrocytosis.
21. Leukocytosis, Leukopenia, Agranulocytosis.
22. Leukemia. Leukemic reactions.
23. Thrombocytosis, Thrombocytopenia, Thrombocytopathy.
24. Pathology of Hemostasis.
25. Pathophysiology of Cardiovascular System.
26. ECG. Violation of Heart Rhythm.
27. Violation of Blood Vessels Tone.
28. Pathophysiology of Respiratory System.
29. Pathophysiology of Liver.
30. Pathophysiology of Digestion System.

31. Pathophysiology of Kidneys.
32. Pathophysiology of Endocrine System.
33. Pathophysiology of Nerve System.

LIST OF AVAILABLE DIAGNOSTIC TOOLS

The following forms are used for competencies assessment:

1. Oral form:
 1. Oral survey;
 2. Discussion;
 3. Colloquiums.
2. Written form:
 1. Written tests with the decision of situational tasks;
 2. Tests;
 3. Control works.
3. Oral-writing form:
 1. Credit;
 2. Exam.
4. Technical form:
 1. Electronic tests.

LIST OF PRACTICAL SKILLS

As a result of studying the discipline «Pathological Physiology» the student should be able:

1. to identify the pathology nature and predict the probability of having a child with a similar pathology in the family according to the characteristic external signs, the results of cytological determination of sex chromatin and the genealogical tables analysis;
2. to model the peripheral blood circulation disorders: arterial and venous hyperemia, ischemia, ischemia/reperfusion;
3. to build a temperature curve; to determine the type and severity of febrile reactions;
4. to know the basics of inflammatory diseases diagnosis; to know the clinical and laboratory markers of inflammation;
5. to determine the type of inflammation according to the inflammatory exudates composition;
6. according to anamnesis, blood and urine tests to determine the nature of acid-base state indicators changes at gas and non-gas acidosis and alkalosis; to analyze possible causes and mechanisms of acid-base state violations, the ways of their correction in the submitted task;
7. to determine the form and severity of radiation sickness;

8. to identify various types of hypoxia in accordance with clinical and laboratory parameters;
9. to diagnose the pathology of blood cells;
10. to determine the hematocrit value; to know its clinical significance;
11. to calculate the erythrocyte indices; to determine the color index and give it clinical evaluation;
12. to assess the bone marrow regenerative capacity;
13. to determine the type of nuclear leukocyte shift;
14. to determine the disorders of hemostasis in accordance with clinical and laboratory parameters;
15. to determine the nature of central hemodynamic parameters changes at various types of heart failure;
16. to detect ECG abnormalities in heart rhythm and signs of myocardial infarction;
17. to know the biochemical aspects of myocardial infarction diagnosis;
18. to determine the typical forms of lungs gas exchange function violation by indicators of ventilation, gas composition of blood and blood flow in the lungs;
19. to differentiate the pathological types of respiration according to the respiratory movement's records. (Cheyne-Stokes, Biota, Kussmaul, Gaspings, apneustic);
20. to determine the typical renal dysfunction according to the analysis of urine and clearance tests;
21. to differentiate the different types of jaundice by biochemical analysis of blood, urine and feces;
22. to recognize the portal hypertension syndrome development in patient and determine its type according to the characteristic symptoms;
23. to determine the typical disorders of gastric secretory function according to the analysis of gastric juice;
24. to solve the situational tasks, to analyze the hemograms and hemostasiograms.

LIST OF LECTURES

VI semester

1. Introductory lecture. General theory of disease.
2. Role of hereditary in pathology.
3. Cell injury.
4. Inflammation.
5. Pathological physiology of thermoregulation. Fever.
6. Pathological physiology of tumor.
7. Hypoxia.
8. Disturbance of acid-base status of organism.

VII semester

1. General issues of the cardiovascular system pathology. Heart failure
2. Disorders of vascular tone regulation (arterial hypertension and hypotension).

3. Pathological physiology of the respiratory system.
4. Pathological physiology of the liver. Portal hypertension
5. Pathological physiology of the kidneys
6. Pathological physiology of the nervous system
7. Pathological physiology of the endocrine system

LIST OF LABORATORY STUDIES

VI semester:

1. The subject and tasks of pathological physiology. Modeling of diseases in experiment. View the movie «Laboratory animals» (maintenance, fixing, injection and other laboratory researches technique).
2. General etiology and pathogenesis. The influence of electric injury on the body. View the slideshow. Test control.
3. Actual questions of nosology.
4. Reactivity of organism and its role in pathology.
5. Role of hereditary in pathology. Solution of situational tasks. Test control.
6. Action of ionizing radiation on the body. Solution of situational tasks. Test control.
7. Peripheral circulatory disorders. Arterial and venous hyperemia, thrombosis, embolism, ischemia (classification, etiology, pathogenesis, manifestations and outcomes).
8. Typical microcirculatory disorders. The definition of the notions sludge and «capillary trophic insufficiency». Test control.
9. Cell injury.
10. Inflammation. Impairments of blood circulation at inflammation.
11. Inflammation. Phagocytosis. Test control.
12. Basic biological features of tumors. Etiology of tumors.
13. The pathogenesis of tumors. The relationship of tumor with organism. Principles of tumor treatment and prophylaxis. Solution of situational tasks. Test control.
14. Hypoxia. Dysbarism. Test control.
15. Pathological physiology of thermoregulation. Fever. Solution of situational tasks. Test control.
16. Disturbance of acid-base status (classification, mechanisms of development, consequences, compensation mechanisms). Solution of situational tasks. Test control.
17. Pathological physiology of water metabolism. Edema (classification, mechanisms of development).

VII semester:

1. Pathological physiology of the blood system. Erythropoiesis, its impairments. Morphofunctional peculiarities of erythrocytes and hemoglobin in pathology.
2. Anemias and erythrocytoses. Test control.

3. Leukopoiesis, its impairments. Leukocytoses, leukopenias agranulocytosis. Test control.
4. Hemoblastoses. Leukomoid reactions. Test control.
5. Impairments of the total blood volume. Blood loss.
6. Impairments of hemostasis. Test control.
7. The final lesson in the section: «Pathological physiology of the blood system». Colloquium.
8. Pathological physiology of the heart failure. Insufficiency of the blood circulation. Acute and chronic blood circulation insufficiency. Test control.
9. Arrhythmias. Impairments of excitability, automatism and conduction of the heart. Test control.
10. Violations of vascular tone. Final seminar lesson on the topic “Pathological physiology of the blood circulation system”. Control work.
11. Pathological physiology of the external respiration system. Typical impairments of pulmonary functions. Test control.
12. Pathological physiology of the liver. Test control.
13. Pathological physiology of the digestion systems. Test control.
14. Pathological physiology of kidneys. Test control.
15. Pathological physiology of the nervous system. Test control.
16. Pathological physiology of the endocrine system. Test control.

**PROTOCOL AGREEMENT OF EDUCATIONAL PROGRAM
FOR PATHOLOGICAL PHYSIOLOGY WITH PROGRAMS OF OTHER DISCIPLINES FOR SPECIALTIES
1-79 01 08 "PHARMACY"**

Name of discipline	Name of the department	Suggestions for redistribution of educational program (working) content	Solution (with the date and protocol number)
1. General chemistry	Department of General Chemistry	Proposals to amend the content of the teaching curriculum – no	Protocol № 10 (29.05. 2018)
2. Normal Physiology	Department of Normal Physiology	Proposals to amend the content of the teaching curriculum – no	Protocol № 10 (29.05. 2018)
3. Biological Chemistry	Department of Biological Chemistry	Proposals to amend the content of the teaching curriculum – no	Protocol № 10 (29.05. 2018)
4. Histology, Cytology and Embryology	Department of Histology, Cytology and Embryology	Proposals to amend the content of the teaching curriculum – no	Protocol № 10 (29.05. 2018)
5. Medical and Biological Physics	Department of Medical and Biological Physics	Proposals to amend the content of the teaching curriculum – no	Protocol № 10 (29.05. 2018)
6. Medical Biology and General Genetics	Department of Biology	Proposals to amend the content of the teaching curriculum – no	Protocol № 10 (29.05. 2018)

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S.A. Zhadan

Design of teaching curriculum and accompanying documents conform to specified requirements

Dean of Pharmacy Faculty of Educational
Institution "Belarusian State Medical
University"

15.07.18



signature

N.S. Gurina

Dean of Medical Faculty for International
Students of Educational Institution
"Belarusian State Medical University"

16.07.18



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Methodologist expert of Educational
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