

**MINISTRY OF HEALTH OF THE REPUBLIC OF BELARUS**  
Educational Institution  
**BELARUSIAN STATE MEDICAL UNIVERSITY**

**APPROVED**

by Rector of the Educational  
Institution «Belarusian State  
Medical University»

S.P.Rubnikovich



24.06.2023

Reg. # UD- 01-28/2324 /edu.

**Контрольный  
экземпляр**

**PATHOLOGIC PHYSIOLOGY**

**Curriculum of the educational institution  
in the academic discipline for the specialty**

**1-79 01 01 «General Medicine»**

Curriculum is based on the educational program «Pathologic Physiology», approved 27.06.2023, registration # УД-01-28/2324/уч.; on the educational plan in the specialty 1-79 01 01 «General Medicine», approved 17.05.2023, registration # L 7-07-0911-01/2324/mf.

**COMPILERS:**

F.I.Vismont, Head of the Pathological Physiology Department of the educational institution «Belarusian State Medical University», D.Sc., Professor, Corresponding Member of National Academy of Sciences of the Republic of Belarus;

S.A.Zhadan, Associate Professor of the Pathological Physiology Department of the educational institution «Belarusian State Medical University», PhD, Associate Professor

**RECOMMENDED FOR APPROVAL:**

by the Department of the Pathological Physiology Department of the educational institution «Belarusian State Medical University»  
(protocol # 11 of 05.05.2023);

by the Scientific and Methodological Council of the educational institution «Belarusian State Medical University»  
(protocol #6 of 27.06.2023)

## EXPLANATORY NOTE

«Pathologic Physiology» is an academic discipline of the «Medical and Biological Module 2» module, which contains systematized scientific knowledge about the life activity of a sick organism, the nature and mechanisms of resistance to diseases, the general patterns of the occurrence, development and outcome of diseases.

The purpose of the discipline «Pathologic Physiology» is the formation of basic professional competence, the basis of which is knowledge of the general patterns and mechanisms of occurrence, development, outcomes of diseases and pathological processes for the detection and prevention of disease states and diseases.

The tasks of the discipline «Pathologic Physiology» is to form students' scientific knowledge about:

the basic concepts of general nosology, the role of the causes and conditions of the external and internal environment, as well as the reactive properties of the human body in the onset, development and outcome of the disease;

causes and mechanisms of typical pathological processes and reactions, their significance for the human body and manifestations in various diseases;

causes, mechanisms and most important manifestations of typical disorders of organs and functional systems of the human body;

risk factors for major non-communicable diseases (cardiovascular, oncological, metabolic diseases);

skills and abilities necessary for interpreting the data of instrumental and laboratory studies and formulating, based on them, a conclusion about the causes and mechanisms of the development of pathology.

The knowledge, abilities and skills acquired in the study of the academic discipline «Pathological Physiology» are necessary for the successful study of the following academic disciplines: «Neurology and Neurosurgery», «Clinical Pathological Physiology», «Clinical Pharmacology», «Internal Diseases», «Surgical Diseases», «Forensic Medicine», «Oncology», «Occupational Diseases», «Endocrinology», «Disaster Medicine», modules «Clinical Pathology and Clinical Diagnostics», «Pediatric Module».

A student who has mastered the content of the educational material of the academic discipline «Pathologic Physiology» should have the following basic professional competence:

BPC. Use knowledge about the etiology and pathogenesis of general pathological processes, typical forms of the human body organs and systems pathology while conducting pathophysiological assessment of the laboratory investigation data.

As a result of studying the discipline «Pathologic Physiology», the student should **know:**

basic concepts of general nosology;

causes, main mechanisms of development and outcomes of typical pathological processes;

the main patterns and mechanisms of the development of the disease and recovery;

compensation mechanisms and principles of correction of structural and functional disorders in typical forms of pathology of organs and systems of the human body;

the role of experimental researches in the studying of pathological processes, their possibilities and limitations, requirements for the experiment and the experimenter;

rules of medical ethics and deontology.

**be able to:**

identify and evaluate pathological and compensatory-adaptive reactions, functional reserves of the human body in various forms of pathology;

carry out pathogenic analysis of hemograms of patients;

give an opinion on the hemogram about the presence of typical forms of pathology of the blood system, to assess the severity of the changes that have occurred;

identify and evaluate typical disorders of the acid-base state, their mechanisms and degree of compensation;

identify the main types of cardiac arrhythmias, liver and kidney function according to clinical and additional research methods;

**master:**

the methods for conducting a pathophysiological analysis of clinical, laboratory and experimental data and formulating, based on them, conclusions about the possible causes and mechanisms for the development of pathology;

the skills of pathophysiological analysis of clinical symptoms and syndromes;

the methods of substantiation and use of etiological and pathogenic principles of prevention and treatment of diseases.

**Total number** of hours for the study of the discipline is 228 academic hours. Classroom hours according to the types of studies: lectures – 22 hours (including supervised student independent work – 7 hours), practical classes – 96 hours, student independent work (self-study) – 110 hours.

Intermediate assessment is carried out according to the syllabus of the specialty in the form of a credit (5th semester) and examination (6th semester).

**ALLOCATION OF ACADEMIC TIME  
ACCORDING TO SEMESTERS OF STUDY**

Code, name of the specialty	semester	Number of academic hours						Form of intermediate assessment
		total	in-class	including			out-of-class self-studies	
				lectures (including supervised independent work)	supervised student independent work	practical classes		
<b>1-79 01 01 «General Medicine»</b>	5	120	58	10	3	48	62	credit
	6	108	60	12	4	48	48	examination
		<b>228</b>	<b>118</b>	<b>22</b>	<b>7</b>	<b>96</b>	<b>110</b>	

## THEMATIC PLAN

Name of section	Number of classroom hours	
	lecturers	practical
<b>1. General nosology</b>	<b>2</b>	<b>18</b>
1.1. Introduction. General questions of the doctrine of disease. General etiology and pathogenesis	2	6
1.2. Pathogenic influence of environmental factors on the human body	-	6
1.3. The role of reactivity, constitution and age in pathology. The role of heredity in pathology	-	6
<b>2. Typical pathological processes</b>	<b>8</b>	<b>30</b>
2.1. Disorders of peripheral circulation and microcirculation	-	6
2.2. Pathophysiology of cell	2	1
2.3. Inflammation	2	5
2.4. Pathophysiology of thermoregulation. Fever and hyperthermia	2	3
2.5. Typical metabolic disorders	-	6
2.6. Hypoxia	-	3
2.7. Tumor growth	2	6
<b>3. Pathophysiology of organs and systems</b>	<b>12</b>	<b>48</b>
3.1. Pathological physiology of the blood system	-	21
3.2. Pathological physiology of the cardiovascular system	2	12
3.3. Pathological physiology of the external respiratory system	2	3
3.4. Pathological physiology of the digestive system and liver	2	3
3.5. Pathological physiology of the kidneys	2	3
3.6. Pathological physiology of the endocrine system	2	3
3.7. Pathological physiology of the nervous system	2	3
<b>Total hours</b>	<b>22</b>	<b>96</b>

## CONTENT OF THE EDUCATIONAL MATERIAL

**1. General nosology****1.1. Introduction. General questions of the doctrine of disease. General 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 diseases treatment.

Brief information on the history of Pathophysiology; main stages of its development. The significance of the works of V.V.Pashutin, A.B.Foht, I.I.Mechnikov, A.A.Bogomolets, N.N.Anichkov, S.S.Halatov, P.N.Veselkina, G.N.Saharov, A.D.Speranskii, L.O.Orbeli, V.V.Parin, I.R.Petrov, N.N.Sirotnin, A.M.Chernukh, P.D.Gorizontov, G.N.Kryzhanovsky, A.D.Ado, R.Virhov, Yu.Kongeym, K.Bernar, U.Kennon, F.Bernet, H.Selye and other most prominent researchers in the pathophysiology development.

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. Experimental therapy as an important method for the study of diseases and the development of new treatment methods.

Basic concepts of general nosology. Norm, health, transition body states between health and disease (pre-disease). The concept of the pathological response, the pathological process, pathological condition, disease. Typical pathological processes. Disease as a dialectical unity of damage and protective-adaptive (sanogenic) reactions of organism; systemic principle in pathology; the integrity of the organism. Stage of the disease, its outcomes. Complete and incomplete recovery. Remission, relapse, complications. Value of biological and social factors in human pathology.

Terminal condition. Dying as a staging process. Preagonal state, the agony, clinical death, biological death. Pathophysiological basis of resuscitation. Post-resuscitation disorder.

The value of biological and social factors in human pathology. Social criteria of the disease. The principles of disease classification.

The definition of the notion «etiology». The role of causes and conditions, the morphofunctional characteristics of the macroorganism, their dialectical relationship in disease occurrence. The concept of external and internal reasons of the disease. The concept of the polyetiological nature of some diseases. Critical analysis of some concepts of general nosology (monocausalism, conditionalism, constitutionalism). The etiotropic principle of prevention and treatment of diseases.

The definition of the notion «pathogenesis». Injury 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».

The definition of the concept «sanogenesis». Protective and compensatory response. The similarities and differences between the concepts of adaptation and compensation. Emergency and long-term of adaptation and compensation reactions, their mechanisms, role in the disease development. The role of the genetic apparatus in the formation of long-term reactions of adaptation and compensation. Pathophysiological «price» adaptation and compensation. Mechanisms for recovery. The phenomenon of decompensation. The pathogenic principles of diseases therapy.

Stress. The concept of stress as a nonspecific reaction of the body to the influence of various extreme stimuli. Stages and mechanisms of stress development; the role of neurohormonal factors. The main manifestations of stress. Protective-adaptive and pathogenic meaning of stress; stress and general adaptation syndrome. The concept of adaptation diseases.

### **1.2. Pathogenic influence of environmental factors on the human body**

Characterization of the physical factors pathogenic effects: mechanical damages, hypo - and hyperkinesia, hypo - and hyperthermia. The weather factors, the consequence of their impact.

The electric current and the peculiarities of its damaging effect on the body.

The effect of ionizing radiation on the body. Acute and chronic radiation sickness. The forms and stages of acute radiation sickness. Long-term consequences of ionizing radiation.

The effect of altered barometric pressure (low and high) on the body. Mountain and altitude sickness. Caisson disease. Pathogenic effects of chemical factors; exo- and endogenous intoxications.

Biological factors. Viruses, rickettsiae, bacteria and parasites as causes of infectious diseases.

Psychogenic pathogenic factors, the concept of iatrogenic diseases. The importance of social factors in maintaining health and the occurrence of human diseases. Ecological aspects of general pathology.

Extreme conditions of existence and extreme states: general characteristics, differences.

### **1.3. The role of reactivity, constitution and age in pathology. The role of heredity in pathology**

The reactivity of the organism, its types, indexes and evolutionary aspects. Reactivity and resistance. Factors determining reactivity (age, sex, individual peculiarities of the organism). The role of reactivity in the infectious process development. Specific and nonspecific protective factors.

The influence of environmental factors on the organism reactivity: the role of social and environmental factors. Pathological reactivity, its types and forms of manifestation. The directional change of individual and group reactivity as the major means of diseases prevention and treatment. Factors that reduce nonspecific resistance. Ways and means of its improvement.

Immunogenic reactivity and basic forms of its violations. Immunodeficiency: primary (hereditary) and secondary (acquired) in infectious diseases, radiation



injuries, protein starvation, intoxication, alcoholism, cancer, aging and other; iatrogenic immunodeficiency states.

Allergy as a form of pathological reactivity. Allergy, its general characteristics and connection with immunity phenomena. Exogenous and endogenous allergens, classification. Types of allergies; drug allergy. Types of allergic reactions, causes and mechanisms of development. Manifestations of immediate and delayed types of allergies. Classification of allergic reactions according to Gell and Coombs. Anaphylactic shock. Hay fever, bronchial asthma, urticaria and Quincke's edema. Serum sickness. The concept of pseudo-allergy.

The concept of autoimmune diseases, their significance in human pathology, classification. Mechanisms of impaired immune tolerance and the occurrence of immune autoaggression.

The doctrine of the constitution. Classification of constitutional types. The value in pathology.

The reasons and mechanisms of aging. Theories of aging. Peculiarities of manifestations and course of the disease in elderly and senile age. Ways to extend the human life.

Hereditary and congenital diseases. Phenocopies. Etiology of hereditary diseases. Mutations; their varieties. Mutagenic factors; the value of ionizing radiation, viruses and environmental pollution in causing mutations; the possibility of drug mutations.

Classification of mutations (gene, chromosomal and genomic). Causes, development mechanisms and types.

Mechanisms of hereditary pathology: loss of normal hereditary information; excess of hereditary information; its replacement by a pathological; violations of regulation of the genetic apparatus activity; untimely realization of genetic information.

Mono - and polygenic hereditary diseases. Penetrance and expressiveness. Chromosomal and genomic diseases. Classification. Characteristics of the main syndromes associated with a violation of the number of autosomes and sex chromosomes, as well as the quality of chromosomes.

Hereditary predisposition to diseases. The importance of heredity in the development of multifactorial diseases.

Methods of hereditary diseases studying, principles of their prevention and possible treatments. The paramount importance of environmental protection.

Pathology of fetal development. The concept of antenatal pathology. Gametopathy, blastopathy, embryopathy, fetopathy. Dead fertility, its etiology. The value of the critical (sensitive) periods in the pathology of the embryo and fetus. Communication fetus pathology with harmful effects on the mother's body.

## **2. TYPICAL PATHOLOGICAL PROCESSES**

### **2.1. Disorders of peripheral circulation and microcirculation**

General hemodynamic bases of local peripheral circulatory disorders. Basic forms of local circulatory disorders: arterial hyperemia, venous congestion, ischemia, stasis. Their types, causes and mechanisms of development, symptoms.

Microcirculation in different types of local circulatory disorders. Ratio of violations of macro-and microcirculation. Changes in the tissues of patients with arterial and venous congestion, ischemia, stasis; their significance and possible consequences. General changes in the body at the local circulatory disorders. Postischemic reperfusion syndrome. Compensatory processes (shunting blood flow, collateral circulation).

Typical microcirculatory disorders. Changes in blood flow and its rheological properties, the walls of microvessels and perivascular tissue; their relationship. Causes and mechanisms of microcirculatory disorders. Hemoconcentration, violation of suspension stability, aggregation and agglutination of red blood cells, «sludge»-phenomenon. Platelet aggregation. Capillary (veritable) stasis.

Disturbances of tone, mechanical integrity, structure, physical and mechanical properties and microvascular permeability. Accumulation in the perivascular space of physiologically active substances, ions, liquid. Capillary-trophic failure.

Thrombosis and embolism as particular causes of local blood flow disturbance. Causes and conditions of thrombosis. Stages and mechanisms of the process of thrombus formation; types of blood clots. Causes and mechanisms of emboli formation; types of emboli. Value, outcomes and consequences of thrombosis and embolism. Ways of prevention and therapy.

Typical violations of lymphodynamics. Mechanical, dynamic and functional resorptive failure of lymphatic vessels.

## **2.2. Pathophysiology of cell**

Cell injury. The definition and characteristic of the concept. Exogenous and endogenous causes of cell injury. The concept of cells self-injury. The role of immune processes in the cells self-injury, as well as their long inactivity, aging, disorders of the nervous system trophic function.

Common mechanisms of cell injury and their manifestation. Direct and indirect effects on the cell damaging agent. The character of arising violations; their specificity. Violations of energy production, transport mechanisms and utilization of energy in the cell. Violations of the permeability and transport functions of cell membranes and cell organelles. Changes in the activity of intracellular enzymes; output of organelles and enzymes from the damaged cells. An imbalance in ion and fluid in a cell.

Role of free radicals in pathological processes development. Damaging effects of active oxygen species and peroxidation products (free-radical) of lipids. Changes in the balance of the cell pro-and antioxidant systems, as one of the typical mechanisms of free radical's pathogenic action. Violations of the structure and functions of individual cell organelles, cell function regulation mechanisms. Changes in receptor properties of cells. Violations of the genetic apparatus and mechanisms of the genetic program realization.

Violation of damaged cells functions and interaction. Reversible and irreversible injury. Manifestation of cell injury, cell dystrophy and dysplasia. Necrosis and autolysis as outcomes of injury.

Cellular mechanisms of compensation at damage. Microsomal detoxification system, buffer systems, cellular antioxidants, anti-mutagenic system. Adaptive

changes in the functional activity of the cell and its genetic apparatus. Cellular and subcellular regeneration. Ways to improve the resistance of cells to the action of pathogenic factors and stimulate recovery processes in damaged cells.

General reactions of the organism to the damage: acute phase response, shock, collapse, coma. Definition of the notion «shock», its types. Pathogenesis of shock states; characteristics of its main components: dysregulation, macro- and microcirculation, metabolism; mechanism and pathogenic assessment of blood flow shunting; centralization of blood circulation. Similarities and differences between individual types of shock. Stages of shock, functional and structural disorders at different stages of shock. The importance of the functional state and reactive properties of the body for the outcome of shock. Irreversible changes in shock. Pathophysiological basis for the prevention and treatment of shock.

Collapse: definition and characteristics of the notion «collapse», its types, causes and mechanisms of development, main links of pathogenesis. Principles of collapse therapy. Fainting: etiology and pathogenesis.

Coma, the definition, characteristics, the types. Etiology and pathogenesis of comatose states, dysfunctions of the human body, principles of treatment.

### **2.3. Inflammation**

The definition of the notion. Local and general signs of inflammation. The etiology of inflammation. Acute inflammation. The main components of the inflammatory process: alteration, changes in blood circulation with exudation and emigration of leukocytes, proliferation.

Primary and secondary alteration at an inflammation. Changes in metabolism, permeability of cell membranes and cell organelles in inflammation site, mechanisms of their development and significance. Mediators of inflammation; their origin classification principles and their role in the inflammatory process, in the development of secondary alteration. The concept of pro-and anti-inflammatory mediators. Interrelation of various mediators.

Reactions of microvascular vessels. Changes in blood flow, their stages and mechanisms. Changes in blood rheology in inflammation site, protein composition and physico-chemical properties of the plasma proteins. Changes in microvascular permeability.

Exudation. Enhancing filtration, diffusion and microvesicles formation as a basis of exudation process. Mechanisms and significance of exudation in inflammation site. Types of exudates.

Marginal position and emigration of leukocytes in inflammation site, their mechanisms.

Phagocytosis; its types, stages, mechanisms and biological significance. Violation of phagocytosis; its causes and significance at an inflammation. Hereditary diseases of phagocytic system. Proliferation, its main manifestations and mechanisms of development.

Reactivity role in the development of inflammation. Communication of local and general phenomena in inflammation. Meaning of endogenous pro-and anti-inflammatory factors, nervous, endocrine and immune systems in the inflammatory process. Inflammation and allergy. Types of inflammation. Classification of types of

inflammation according to the speed of development, the predominant phase, and the reactivity of the body.

Chronic inflammation (primary and secondary), causes and patterns of development. Pathogenic features of acute and chronic inflammation.

Dialectical relationship of damage and protective-adaptive reactions in the inflammatory process. Outcomes of inflammation. Value of an inflammation to the body. The basic theories of the inflammation pathogenesis. The principles of anti-inflammatory therapy. Phylogenesis and ontogenesis of inflammatory reaction.

Infectious process as a form of interaction between micro- and macroorganisms. Mechanisms of anti-infective resistance of the body. The ways of introduction of infectious agents into the body and their spread. Stages of the infectious process, outcomes and complications. Sepsis, etiology and pathogenesis. Coronavirus infection.

Ways to prevent infectious diseases. Principles of therapeutic intervention in the infectious process: impact on infectious agents, correction of the immune response; stimulation of nonspecific resistance mechanisms.

#### **2.4. Pathophysiology of thermoregulation. Fever and hyperthermia**

The definition and general characteristics of fever. Etiology of fever. Infectious and non-infectious fever. Pyrogenic substances: primary and secondary, exogenous and endogenous, their chemical nature and the sources of formation at infection process, aseptic tissue damage and immune reactions. Mechanisms of realization of pyrogens actions. Mediators of fever. Stages of fever. Thermoregulation at different stages of fever. Meaning of thermosensitive zones of the hypothalamus and peripheral receptors in restructuring of thermoregulation at a fever. Types of febrile reactions. Dependence of fever development on the properties of the pyrogenic factor and organism reactivity. Temperature curves, their diagnostic value.

Participation of the nervous, endocrine and immune systems in the development of fever. Changes in metabolism and physiological functions at a fever. Meaning of febrile response to the organism. Features of febrile response in the neonatal period and in elderly patients. Principles of analgesic therapy. Difference between fever and exogenous overheating and other types of hyperthermia.

Principles of antipyretic therapy. Concept of pyrotherapy.

#### **2.5. Typical metabolic disorders**

Disturbances of acid-base status. Classification of the main types of violations of the acid-base status of internal environment of the body. Gas (respiratory) acidosis and alkalosis. Non-gas forms of acidosis and alkalosis: metabolic, excretory (renal and gastro), exogenous. Mixed forms. Compensatory reactions in acute and chronic disorders of acid-base balance. Changes of acid-base balance parameters in the body at different types of acidosis and alkalosis. Principles of correction.

Disorders of water metabolism. Hyper-, iso- and hypoosmolar hypohydration. Hyper-, iso- and hypoosmolar hyperhydration. Edema. Pathogenic factors of edema; value of hydrodynamic, osmotic and oncotic pressure gradients in the blood and tissues, state of vascular tissue membranes. The role of neuro-hormonal mechanisms in the development of edema. Types of edema. Pathogenesis of cardiac, renal,

inflammatory, allergic, hungry edema. Local and general edema violations, the principles of their therapy, experimental models.

Violations of electrolyte metabolism. Violation of the content and ratio of sodium, potassium, calcium, magnesium ions and microelements in body fluids between cellular and extracellular sectors. The underlying causes and mechanisms of electrolyte imbalance. The relationship between water, ion and acid-base balance. Disorders of metabolism and physiological functions in the most frequent forms of electrolyte imbalance.

Carbohydrate metabolism disturbances. Violations of carbohydrate foods suction, the processes of synthesis, deposition and glycogen disintegration, transport of carbohydrate into cells and digestion of carbohydrates. Hypoglycemia, types and mechanisms of origin. Hyperglycemia. Diabetes mellitus and its types. The etiology and pathogenesis of various diabetes types. The mechanisms of insulin resistance. Disorders of carbohydrate and other kinds of metabolism at diabetes; disorders of physiological functions, complications; their mechanisms. Diabetic coma. Carbohydrate metabolism disturbances in hereditary enzymopathies. Glycogenoses.

Violations of protein metabolism. Positive and negative nitrogen balance. Causes of protein deficiency and its consequences. Disorders of amino acid metabolism. Dysproteinemia, its types and consequences. Violations of protein metabolism final stages, urea synthesis. Hyperasotemia. Violations of the blood plasma protein composition: hyper, hypo- and dysproteinemia.

Pathology of nucleoprotein metabolism. Disorders of purine and pyrimidine bases metabolism. The role of exogenous and endogenous factors in the development of gout. The ways of prophylactics.

Lipid metabolism disorders. Primary and secondary dyslipidemia. Dislipoproteinemia, classification.

General obesity; its types and mechanisms. Violation of phospholipids metabolism. Hyperketonemia. Violation of cholesterol metabolism; hypercholesterolemia. Atherosclerosis and its pathogenic mechanisms and negative effects.

Starvation. Exogenous and endogenous causes of starvation. Absolute, complete, incomplete, partial starvation; protein starvation. Protein-energy (protein-energy) deficiency, its types: alimentary marasmus, Kwashiorkor-disease, alimentary dystrophy. Periods of complete starvation; changes in metabolism and physiological functions in different periods of complete starvation. Concept of medical starvation.

Pathology of water- and fat-soluble vitamins metabolism. Manifestations of hypovitaminosis, avitaminosis and hypervitaminosis. Etiology and pathogenesis.

Typical metabolic disorders as risk factors for main noninfectious diseases (cardiovascular disease, cancer, diabetes).

## **2.6. Hypoxia**

Definition of hypoxia as the state of absolute or relative biological oxidation deficiency. The role of hypoxia in the pathogenesis of various diseases and pathological processes. Stability of individual organs and tissues to oxygen starvation. Principles of hypoxia classification. Types of hypoxia. Etiology and pathogenesis of hypoxia major types: hypoxic, hyperoxic, respiratory, circulatory,

hemic, tissue, mixed origin. Hypoxia during uncoupling of oxidation and phosphorylation, overload hypoxia. Hypoxia as consequence of oxidation substrates deficit. Mixed forms of hypoxia. Laboratory parameters of gas composition of arterial and venous blood at certain types of hypoxia.

Emergency and long-term reactions of adjustment and compensation during hypoxia; their mechanisms.

Urgent and long-term reactions of adjustment and compensation during hypoxia; their mechanisms.

Violation of metabolism, structure and function of cells and physiological functions at acute and chronic hypoxia. Reversibility of hypoxic conditions. Influence of hyper- and hypocapnia on the development of hypoxia. Pathophysiological bases of hypoxic conditions prevention and treatment. Experimental models of various types of hypoxia. Mechanisms of adaptation and compensation. Protective effects of adaptation to hypoxia. Local hypoxia in the pathogenesis of inflammatory and dystrophic lesions of the maxillofacial area tissue.

Hyperoxia: definition and its role in pathology. The therapeutic effect of hyperoxia: hyperbaric oxygen therapy and its application in dentistry.

## **2.7. Tumor growth**

The definitions of the notions «tumor growth» and «tumor». Spread of tumors in nature, phylogenesis and ontogenesis.

Etiology of tumors; physical and chemical blastomogenic factors, biological carcinogens.

Chemical carcinogenic factors, their classification, procarcinogens and the final (true) carcinogens. Cocarcinogens and sincarcinogens.

Physical carcinogenic factors. Ionizing radiation as a blastomogenic factor.

Carcinogens of biological nature. Types of oncogenic viruses.

The importance of hereditary factors, gender, age, chronic diseases in the appearance of tumors in humans.

Biological features of tumor growth, relative autonomy and unregulated tumor growth, simplification of structural chemical organization (atypism, its types), the tumors and embryonic tissues similarities and differences. Metastasis (the definition, stage, mechanisms). Recurrence of tumors.

Malignant and benign tumors, peculiarities of their growth. Metabolic, functional and antigenic properties of malignant cells. Features and mechanisms of the invasive and destructive growth. Tumor progression.

Theory of the tumors pathogenesis. Modern ideas about the molecular and genetic mechanisms of carcinogenesis. The concept about the cellular proto-oncogenes and anti-oncogenes and their role in oncogenesis. Mechanisms of proto-oncogene transformation in active oncogene. Nature of oncoproteins and possible mechanisms of action. The role of mutation, epigenetic, virus-genetic mechanisms in carcinogenesis. Precancerous conditions.

Antineoplastic body resistance, immune and non-immune factors of resistance. Depression antineoplastic resistance value in the occurrence and development of tumors. The tumor and the body interaction. Role and reaction of the nervous and endocrine systems. Systemic manifestations of neoplastic disease. Cancer cachexia.

Pathophysiological bases for prevention and therapy of tumors.

### **3. PATHOPHYSIOLOGY OF ORGANS AND SYSTEMS**

#### **3.1. Pathophysiology of the blood system**

Periods and types of hematopoiesis and their disorders.

Erythron pathology. Pathological forms of red blood cells and hemoglobin. Anemias and erythrocytosis, definition of notions, principles of classification by: the etiology and pathogenesis, hematosis type, the color index, regenerative ability of bone marrow, the size and shape of red blood cells. Iron deficiency anemia. Anemia with a deficiency of vitamin B<sub>12</sub> and folic acid (megaloblastic anemia), erythropoietin deficiency and other erythropoiesis factors. Achrestic anemias.

Anemias due to suppression of erythropoiesis by toxic effects, ionizing radiation and during autoimmune processes. Hypo- and aplastic anemias. Anemia at leukemia and other tumors of the bone marrow.

Anemias due to the enhanced hemolysis. Hereditary hemolytic anemias (erythrocytopathies, erythroenzymopathies, hemoglobinopathies). Acquired hemolytic anemias. Role of autoimmune processes in the pathogenesis of anemias.

Acute and chronic hemorrhagic anemias.

Erythrocytosis: primary (erythremia) and secondary (absolute and relative erythrocytosis).

Violations and compensatory-adaptive processes in the body with anemia and polycythemia.

Pathology of leukon. Disruption of the structure and function of the individual types of leukocytes and their role in pathological processes. Leukocytosis, leukopenia, agranulocytosis, their types, causes and mechanisms of development. Changes in leukocyte formula. Panmyelophthisis.

Concept of hemoblastoses. Leukemias. Definition, general characteristics, principles of classification. Tumor nature of leukemias, the role of abnormal expression of oncogenes. The etiology of leukemias, the role of viruses, chemical carcinogens, ionizing radiation. Leukemic cells feature, their morphological, cytochemical, cytogenetic and immunological characteristics. Hematopoiesis features and peripheral blood cell composition during different types of leukemias. Principal disturbances in the body with leukemia, their mechanisms. Principles of diagnosis and therapy of leukemias.

Leukemoid reactions. Types of leukemoid reactions, their etiology, pathogenesis, hematopoiesis and morphological changes of the peripheral blood, the difference from leukemia and value for the organism.

Violations of the hemostatic system. Thrombocytosis, thrombocytopenia, thrombocytopathy. Hemorrhagic and thrombotic syndromes. Hereditary and acquired forms of violation of vascular-platelet hemostasis and coagulation hemostasis. Thrombohemorrhagic hemostasiopathies. Disseminated intravascular coagulation syndrome (DIC syndrome), stages of development, clinical manifestations, consequences.

Changes of total blood volume: hypo- and hypervolemia, their types, causes mechanisms and value for the organism. Acute hemorrhage as the most common

cause of hypovolemia. Emergency and long-term protective and adaptive reactions of the organism at blood loss: the restoration of the blood volume, plasma proteins and formed elements. Disorders of physiological functions at blood loss and during posthemorrhagic states; reversible and irreversible changes. Principles of hemorrhage therapy.

### **3.2. Pathophysiology of the cardiovascular system**

General etiology and pathogenesis of the circulatory system functions disorders. Risk factors in the occurrence of cardiovascular disease: managed and unmanaged. Value of psycho-emotional factors. The notion of circulatory failure, it forms the basic hemodynamic parameters and manifestations.

Heart failure, its kinds. Overload form of heart failure. Overloading by blood volume and blood pressure in the cavity of the heart, the etiology and pathogenesis. The concept of the systolic and diastolic failure. Myocardial form of heart failure, its causes and mechanisms.

Short-term and long-term intracardiac compensation mechanisms of heart failure. Myocardial hypertrophy, peculiarity of the hypertrophied heart, the mechanisms of its decompensation.

General and hemodynamic manifestations of heart failure. Principles of treatment and prevention of heart failure.

Myocardial form of heart failure. Coronary insufficiency, absolute and relative. Pathogenesis of ischemic coronary insufficiency syndrome. Clinical forms of coronary insufficiency. Coronary heart disease, its forms, causes and mechanisms of development. angina pectoris. Myocardial infarction, metabolic disorders, electrogenic and contractile properties of the myocardium in the ischemic area and beyond. Complications and outcomes of angina pectoris and myocardial infarction. Restoring blood flow to the ischemic area. Pathogenesis and clinical manifestations of myocardial reperfusion injury. Noncoronary form of heart damage.

Myocardial damage during systemic diseases (diabetes mellitus, beriberi, obesity, endocrine disorders, collagenoses).

Cardiac arrhythmias. Types (arrhythmias due to impaired automaticity, excitability and conduction), causes, mechanisms, signs on the electrocardiogram. Disorders of systemic and coronary circulation during cardiac arrhythmias. Principles of arrhythmia therapy.

Typical vascular tone disorders. Arterial hypertension. Primary (essential) arterial hypertension, its etiology, pathogenesis theories, stabilizing factors of high blood pressure. Secondary («symptomatic») arterial hypertension, types, causes and mechanisms of development. Hemodynamics at different types of arterial hypertension. Complications and consequences of arterial hypertension. Target organs damage during arterial hypertension. Experimental models of arterial hypertension. The relationship between arterial hypertension and atherosclerosis.

Arterial hypotension. Types, causes and mechanisms of development. Essential arterial hypotension. Collapse. Disorders of macro- and microcirculation during shock, fainting, collapse. Pathogenic assessment of shunting and centralization of blood circulation in shock.



Pathophysiology of cerebral circulation. General etiology and pathogenesis. Main forms of disorders. Pathological reactions of cerebral vessels. The main forms of cerebral circulatory disorders (paroxysms, crises, strokes), their general characteristics.

The role of atherosclerosis in the pathology of the cardiovascular system.

### **3.3. Pathological physiology of the external respiratory system**

Etiology and pathogenesis of external respiration disorders. Concept of respiratory failure, its stages and manifestations. Shortness of breath, its types, mechanisms of development.

Alveolar hypoventilation. Obstructive and restrictive types of ventilation disorders, their causes and mechanisms. Upper airway obstruction. Acute mechanical asphyxia, causes and mechanisms of development. Obstruction of the lower respiratory tract: pathogenesis of bronchial and emphysematous types of obstruction. Dysregulation of breathing. Reflex respiratory disorders, lesions of the respiratory center. Pathological forms of breathing. Respiratory arrhythmia, periodic breathing, terminal breathing, apnea.

Disorders of pulmonary blood flow, their causes and consequences. General pulmonary perfusion failure. Pulmonary hypertension, pre- and post-capillary form. Local irregularity of ventilation-perfusion relationships.

Violations of blood-air diffusion. Their causes and consequences. Mixed forms of external respiration violations. Etiology and pathogenesis of acute respiratory failure at respiratory distress syndrome of adults and newborns.

Characteristics of spirogram and pneumotachogram indicators in the pathology of alveolar ventilation.

Compensatory-adaptive processes in the system of external respiration in case of its individual units damage. Alveolar hyperventilation: its causes, mechanisms and consequences. Changes in ventilation rate, blood gas and acid-base status at respiratory failure and hyperventilation.

Importance of protecting the purity of air and the fight against smoking for prevention of external respiration diseases.

Pathophysiological principles of respiratory failure prevention and treatment.

### **3.4. Pathological physiology of the digestive system and liver**

General etiology and pathogenesis of the digestive system disorders. The role of food and nutrition. Significance of neurogenic and humoral factors. Pathogenic effects of smoking and alcohol. Functional relationships of the digestive system different parts in pathological conditions. Digestive disorders during metabolic disorders.

Appetite disorders: hyporexia, anorexia, pararexia, bulimia, polyphagia, polydipsia.

Disorders of taste sensations. Violations of salivation, hypo- and hypersalivation. Violations of mastication, swallowing and esophageal function.

Violations of the reservoir, the secretory and motor functions of the stomach. Types of pathological secretion. Hypo- and hyperkinetic stomach conditions. Violations of gastric contents evacuation: belching, heartburn, nausea, and vomiting. Relationship of secretory and motor disorders. Disorders of the small intestine and

colon. Violations of secretory function. Meaning damage enterocytes, pancreatic achylia, acholia; role of gastrointestinal hormones. Violations of the cavernous and parietal digestion; malabsorption. Intestinal dysmotility. Diarrhea, constipation, intestinal obstruction. Violations of the intestinal barrier function, intestinal autointoxication, Coli-septicemia and dysbacterioses. Enteritis, colitis. Peptic ulcer and symptomatic ulcers of the stomach and duodenum. Etiopathogenesis. Characteristics of aggression and defense factors and their disturbance in the development of gastric and duodenal ulcers. The role of stress.

Violations of the pancreas secretory function; acute and chronic pancreatitis. Role in the occurrence of digestive disorders.

Principles of prevention and treatment of major disorders of digestive system.

General etiology and pathogenesis of the liver diseases. Violations of the portal circulation, the arterial blood supply of the liver. Parenchymal liver damage: inflammatory (acute and chronic hepatitis), dystrophic, cholangiostatic. Cirrhosis of the liver. Violations of biliary excretion. The role of autoimmune mechanisms in the liver pathology.

Hepatic failure: cholestatic, hepatocellular, vascular, mixed. Manifestations of liver failure. Disorders of carbohydrate, protein, lipid, water-electronic exchange, the hormonal regulation of the composition and physic-chemical properties of the blood during hepatic failure. Abnormalities of the barrier and disintoxication liver function. Acute hepatic failure, hepatic coma.

The main syndromes in liver pathology. Jaundice, their types: suprahepatic, liver, obstructive; their causes, mechanisms, manifestations. Disorders of bilirubin metabolism in various types of jaundice. Syndromes of cholestasis, cholemia, acholia. Etiopathogenesis of cholelithiasis.

Hematological, endocrine and Banti's syndromes. Portal hypertension syndrome. Pathogenic assessment of its symptoms.

Dystrophic, oncological and alcoholic liver diseases. The role of hepatotropic poisons in their pathogenesis.

The role of hepatotropic poisons in the pathogenesis of dystrophic, oncological and alcoholic liver damage. The role of liver pathology in digestive disorders.

Principles of prevention and treatment of liver pathology.

### **3.5. Pathological physiology of the kidneys**

Common elements in the etiology and pathogenesis of different renal function impairments. Impairments of renal hemodynamics, urine flow, renal parenchymal; disorders of urine formation neuro-humoral regulation; renal enzymopathy. Violation mechanisms of glomerular filtration, proximal and distal tubular reabsorption, tubular secretion and excretion; mixed violations.

Manifestations of renal function disorders. Changes in diuresis and urine composition, polyuria, oliguria, anuria, hypo- and hypersthenuria, izostenuriya pathological urine components of renal and extrarenal origin. Changes in the composition and physic-chemical properties of blood. Manifestations of hereditary tubulopathy.

Concept of glomerulopathy. Acute and chronic diffuse glomerulonephritis, pyelonephritis, etiology, pathogenesis.

Changes in diuresis in acute and chronic glomerulonephritis. Characteristics of renal and extrarenal manifestations in glomerulonephritis.

Nephritic and nephrotic syndrome. Acute renal failure (acute kidney injury) and chronic kidney disease: etiology, pathogenesis, stages. Uremia. Principles of treatment of kidney pathology.

### **3.6. Pathological physiology of the endocrine system**

General etiology and pathogenesis of endocrine disorders. Violations of the central mechanisms of the endocrine glands regulation. Excess, deficiency and imbalance of releasing and inhibiting factors of the midbrain (liberines and statines); violation of feedback and self-regulation mechanisms in the neuroendocrine system, trans-, para-adenohypophysis mechanisms of regulatory disorders. Psychogenic endocrinopathies.

Primary disorders of hormone synthesis in peripheral endocrine glands as a consequence of pathological processes in the glandular tissue, depletion on the basis of long-term hyperfunction, deficiency of the necessary components for the synthesis of hormones; genetically determined defects in hormone biosynthesis. Iatrogenic endocrinopathies.

Peripheral (extraglandular) mechanisms of disorders violations of hormone effect realization: binding disorders and the «liberation» of hormones by blood proteins, blockade, excessive destruction and other metabolic disorders in tissues, absence or change in properties of hormone receptors in target cells.

The main types of endocrine disorders. Hypo-, hyper- and dysfunctional; mono- and pluriglandular; partial and total endocrinopathies; early and late; primary, secondary and tertiary; absolute, relative and relative-absolute forms.

General characteristics of detection methods and principles of endocrine disorder treatment. Endocrine disorder role in etiology and pathogenesis of non-endocrine diseases.

Typical forms of disorders of individual endocrine gland functions. Pathology of the hypothalamic-pituitary system. Hyperfunction and hypofunction of the anterior pituitary gland. Hyper- and hypofunction of the posterior pituitary gland. Total failure of the pituitary gland.

Pathophysiology of the adrenal glands. Typical forms of disease (hypo- and hyperfunctional state), their manifestations.

Pathophysiology of the thyroid gland. Hypo- and hyperthyroidism, thyrotoxicosis.

Pathophysiology of parathyroid glands: hypoparathyroidism, hyperparathyroidism.

Pathophysiology of the gonads. Hypo- and hypergonadism in women and men, development mechanisms, clinical manifestations, treatment principles.

Violations of endocrine function of the pancreas.

Dyshormonal disorders of the maternal body, their significance in the development of fetal endocrinopathies and pregnancy.

### **3.7. Pathological physiology of the nervous system**

General etiology of nervous system function disorders, exogenous and endogenous etiological factors, the significance of social conditions, primary and

secondary disorders. The role of social factors in the occurrence of disorders of nervous activity, the significance of household intoxications; the possibility of a medicinal origin of these disorders. Inflammatory, vascular, post-traumatic and oncological diseases of the nervous system.

Typical disorders in the nervous system. Pathology of neuron and synaptic transmission. Etiopathogenesis. Myasthenia. Denervation syndrome. The role of the generator of enhanced excitation, pathological dominance, pathology of excitation and inhibition, pathological deafferentation. Etiopathogenesis. Consequences. The role and consequences of mediator disorders in the occurrence of pathology of the nervous system.

Neurogenic movement disorders. Hypo- and hyperkinetic states. Central and peripheral paralysis and paresis. Comparative characteristics. Pathology of the extrapyramidal system. Hypokinetic-hypertensive syndrome (parkinsonism). Hyperkinetic-hypotonic syndrome (chorea). Manifestations of hyperkinesis. Mechanisms of occurrence. Epilepsy. Ataxia, its causes.

Neurogenic sensory disorders. Types of sensory disorders. Pain: developmental mechanisms and biological significance.

Neurogenic autonomic disorders, types and main manifestations. The concept of vegetative dystonia. Neurogenic trophic disorders: neurogenic atrophies and dystrophies. Disorders of higher nervous activity. Classification. Neuroses. Definition and general characteristics. Biological and social aspects of neuroses. Experimental models of neuroses. The main manifestations of neurosis.

## ACADEMIC DISCIPLINE CURRICULAR CHART

Section, topic #	Section (topic) name	Number of hours			Self-studies	Form of control
		lectures (including supervised student independent work)	supervised student independent work	practical		
	<b>5 semester</b>	<b>10</b>	<b>3</b>	<b>48</b>	<b>62</b>	
<b>1.</b>	<b>GENERAL NOSOLOGY</b>	<b>2</b>	<b>1</b>	<b>18</b>	<b>22</b>	
<b>1.1.</b>	<b>Introduction. General questions of the doctrine of disease. General etiology and pathogenesis</b>	<b>2</b>	<b>1</b>	<b>6</b>	<b>8</b>	
	Introduction to the discipline «Pathologic Physiology». General questions of the doctrine of the disease	2	1	-	1	
	Introduction to the discipline «Pathologic Physiology». Subject, tasks, methods of pathological physiology	-	-	3	4	Discussion, control work, written reports on practical work, electronic tests
	General questions of the doctrine of the disease. General etiology and pathogenesis	-	-	3	3	Discussion, control work, written reports on practical work, electronic tests
<b>1.2.</b>	<b>Pathogenic influence of environmental factors on the human body</b>	<b>-</b>	<b>-</b>	<b>6</b>	<b>6</b>	
	The effect of electric current on the body	-	-	3	3	Discussion, tests, reports on practical work with their oral defense
	The damaging effect of ionizing radiation	-	-	3	3	Discussion, tests, reports on classroom practical exercises with their oral defense

<b>1.3.</b>	The role of reactivity, constitution and age in pathology. The role of heredity in pathology	-	-	<b>6</b>	<b>8</b>	Discussion, tests, abstracts, reports on practical work with their oral defense
	The role of reactivity, constitution, age and heredity in pathology development			3	3	
	Final lesson on the section «General Nosology». Colloquium	-	-	3	5	Discussion, electronic tests
<b>2.</b>	<b>TYPICAL PATHOLOGICAL PROCESSES</b>	<b>8</b>	<b>2</b>	<b>30</b>	<b>40</b>	
<b>2.1.</b>	<b>Disorders of peripheral circulation and microcirculation</b>	-	-	<b>6</b>	<b>6</b>	
	Arterial and venous hyperemia, ischemia, stasis	-	-	3	3	Discussion, tests, control work
	Thrombosis, embolism, microcirculation disorders	-	-	3	3	Discussion, electronic tests
<b>2.2.</b>	<b>Pathophysiology of cell</b>	<b>4</b>	<b>1</b>	<b>6</b>	<b>10</b>	
<b>2.3.</b>	<b>Inflammation</b>	<b>2</b>	<b>0,5</b>	-	<b>2</b>	Discussion
	Cell Injury (lecture)	2	0,5	-	2	Discussion
	Inflammation (lecture)	2	0,5	-	2	Discussion
	Pathophysiology of the cell. Cell injury. General cell injury mechanisms. Inflammation. Vascular reaction in the focus of inflammation	-	-	3	3	Discussion, electronic tests, electronic practicums
	Inflammation. Phagocytic reaction in the focus of inflammation	-	-	3	3	Discussion, electronic tests, electronic practicums
<b>2.4.</b>	<b>Pathophysiology of thermoregulation. Fever and hyperthermia</b>	<b>2</b>	<b>0,5</b>	<b>3</b>	<b>5</b>	
	Fever (lecture)	2	0,5	-	2	Discussion
	Pathology of thermoregulation. Fever	-	-	3	3	Discussion, written reports on practical work, electronic tests
<b>2.5.</b>	<b>Typical metabolic disorders</b>	-	-	<b>6</b>	<b>6</b>	
	Typical violation of metabolism. Acid-base balance impairments	-	-	3	3	Discussion, written reports on practical work, electronic tests

	Typical metabolic disorders. Pathological physiology of water metabolism. Swelling and dropsy	-	-	3	3	Discussion, reports at practical classes, electronic tests
<b>2.6.</b>	<b>Hypoxia</b>	-	-	<b>3</b>	<b>3</b>	Discussion, tests
<b>2.7.</b>	<b>Tumor growth</b>	<b>2</b>	<b>0,5</b>	<b>6</b>	<b>10</b>	
	Tumor growth (lecture)	2	0,5	-	2	Discussion
	Pathophysiology of tissue growth. Etiology of tumors. Mechanisms of carcinogenesis	-	-	3	3	Discussion, tests, written reports on practical work
	Final lesson on the section «Typical Pathological Processes»			3	5	Discussion, colloquium, electronic tests, reports on classroom practical exercises with their oral defense, abstracts. Credit
	<b>6 semester</b>					
<b>3.</b>	<b>Pathophysiology of organs and systems</b>	<b>14</b>	<b>4</b>	<b>48</b>	<b>48</b>	
<b>3.1</b>	<b>Pathophysiology of the blood system</b>	-	-	<b>21</b>	<b>21</b>	
3.1.	Pathophysiology of the blood system. Periods of blood formation. Typical forms of pathology and reactive changes in the erythrocyte system	-	-	3	3	Discussion, tests
	Anemia. Erythrocytosis	-	-	3	3	Discussion, tests, solving situational problems based on clinical cases
	Typical forms of pathology and reactive changes in the leukocyte system. Leukocytosis, leukopenia	-	-	3	3	Discussion, reports on classroom practical exercises with their oral defense, solving situational problems based on clinical cases
	Hemoblastosis. Leukemoid reactions	-	-	3	3	Discussion, reports on classroom practical exercises with their oral defense, solving situational problems based on clinical cases
	Hemostasis disorders	-	-	3	3	Discussion, electronic tests, reports on classroom practical exercises with their oral defense,

	Changes in the total blood volume: hypo- and hypervolemia. Acute blood loss	-	-	3	3	Discussion, electronic tests, reports on classroom practical exercises with their oral defense.
	The final session on «Pathology of Blood System».	-	-	3	3	Discussion, tests, control work, solving situational problems based on clinical cases, colloquium
<b>3.2.</b>	<b>Pathological physiology of the cardiovascular system</b>	<b>2</b>	<b>1</b>	<b>12</b>	<b>12</b>	
	Pathophysiology of the cardio-vascular system. Heart failure (lecture)	2	1	-	1	
	Pathophysiology of the cardio-vascular system. Heart failure, its types. Overload and myocardial forms of the heart failure	-	-	3	2	Discussion, tests
	Heart rate disorders (arrhythmias), types, causes, mechanisms	-	-	3	3	Discussion, electronic tests, written reports on practical work,
	Vascular tone regulation disorders. Arterial hypertension and hypotension	-	-	3	3	Discussion, tests, control work, solving situational problems based on clinical cases,
	The final session on section «Pathophysiology of the cardio-vascular system»	-	-	3	3	Colloquium
<b>3.3.</b>	<b>Pathological physiology of the external respiratory system</b>	<b>2</b>	<b>0,5</b>	<b>3</b>	<b>3</b>	Discussion, electronic tests, reports on classroom practical exercises with their oral defense
<b>3.4.</b>	<b>Pathological physiology of the digestive system and liver</b>	<b>2</b>	<b>0,5</b>	<b>3</b>	<b>3</b>	Discussion, electronic tests, reports on classroom practical exercises with their oral defense
<b>3.5.</b>	<b>Pathological physiology of the kidneys</b>	<b>2</b>	<b>0,5</b>	<b>3</b>	<b>3</b>	Discussion, electronic tests, reports on classroom practical exercises with their oral defense
<b>3.6.</b>	<b>Pathological physiology of the endocrine system</b>	<b>2</b>	<b>0,5</b>	<b>3</b>	<b>3</b>	Discussion, tests, reports on classroom practical exercises with their oral defense



<b>3.7. Pathological physiology of the nervous system</b>	2	1	3	3	Discussion, solving situational problems based on clinical cases, reports on classroom practical exercises with their oral defense Exam
<b>Total hours</b>	<b>22</b>	<b>7</b>	<b>96</b>	<b>108</b>	

## INFORMATION AND INSTRUCTIONAL UNIT

### LITERATURE

#### **Basic (relevant):**

1. Pathophysiology : textbook for students of higher medical educational institutions of the III-IV accreditation levels / N. V. Krishtal [et al.]; ed. by.: N. V. Krishtal, V. A. Mikhnev. – Kyiv : AUS Medicine Publishing, 2017. - 656 p.

#### **Additional:**

2. General and clinical pathophysiology : textbook for students of higher educational institutions, of IV the level of accreditation / A. V. Kubyshkin [et al.] ; ed. by A. V. Kubyshkin, A. I. Gozhenko.- 2nd ed. - Vinnytsya : Nova Knyha. Publishers, 2016. - 656 p.

3. Pathophysiology : textbook for students / P. F. Litvitsky, S. V. Pirozhkov, E. B. Tezikov. – Moscow : Geotar-Media, 2016. – 432 p.

4. Kumar, V. Robbins and Cotran Pathologic Basis of Disease. V. II / V. Kumar, A. K. Abbas, J. C. Aster. - South Asia ed. - India : Elsevier, 2015. - 1391 p.

5. Simeonova, N. K. Pathophysiology : textbook for students of higher medical educational institutions of the III-IV accreditation levels / N. K. Simeonova; ed. by V. A. Mikhnev. - 2nd ed.- Kyiv : AUS Medicine Publishing, 2015. - 544 p.

#### **METHODOLOGICAL RECOMMENDATIONS FOR THE ORGANIZATION AND PERFORMANCE OF SUPERVISED STUDENT INDEPENDENT WORK IN THE ACADEMIC DISCIPLINE**

##### **The time allotted for independent work can be used by students to:**

preparation for practical exercises;  
preparation for tests and exams in the academic discipline;  
study of the topics (questions) submitted for independent study;  
problem solving;  
preparation of the thematic reports, abstracts, presentations;  
implementation of the practical tasks.

#### **METHODOLOGICAL RECOMMENDATIONS FOR ORGANIZING AND IMPLEMENTING OF MANAGED INDEPENDENT WORK OF STUDENTS IN AN ACADEMIC DISCIPLINE**

##### **The basic forms of organizing managed independent work are:**

writing and presentation of an abstract;  
giving a report;  
studying the topics and problems that are not covered in lectures;  
the computer testing;  
preparation and participation in active forms of learning.

##### **Control of controlled independent work is carried out in the form of:**

control work;  
final lesson, colloquium in the form of an oral interview, written work, testing;  
discussion of abstracts;

protection of educational tasks;  
 assessment of an oral answer to a question, message, report or problem solution;  
 verification of abstracts, written reports, reports, recipes;  
 individual conversation.

#### LIST OF AVAILABLE DIAGNOSTIC TOOLS

The following forms are used to diagnose competencies:

##### **Oral form:**

discussion;  
 colloquia;  
 reports at practical classes;  
 credit;  
 exam.

##### **Written form:**

tests;  
 control works;  
 written reports on practical work;  
 abstracts.

##### **Oral and written form:**

reports on classroom practical exercises with their oral defense;  
 solving situational problems based on clinical cases;  
 reports on practical work with their oral defense.

##### **Technical form:**

electronic tests;  
 electronic practicums.

#### LIST OF AVAILABLE DIAGNOSTIC TOOLS

Traditional method (lecture, laboratory lessons);

Active (interactive) methods:

- Problem-Based Learning (PBL);
- Case-Based Learning (CBL).

#### LIST OF PRACTICAL SKILLS

1. Pathogenic analysis of hemograms of patients with various forms of pathology of the blood system, formulation of the conclusion.
2. Pathophysiological analysis of indicators of the acid-base state with the formulation of a conclusion about the causes, mechanisms of development, the degree of compensation for typical forms of disorders.
3. Pathophysiological analysis of clinical and laboratory data, formulation on their basis of a conclusion about the possible causes and mechanisms for the development of pathology of organs and systems of the human body.
4. Recognition of typical forms of cardiac arrhythmias according to electrocardiography data.
5. Recognizing types of fevers by temperature curve.

## LIST OF LECTURES

### 5th semester

1. Introduction to the discipline «Pathologic Physiology». General questions of the doctrine of the disease.
2. Cell damage.
3. Inflammation.
4. Fever.
5. Tumor growth.

### 6th semester

1. Pathological physiology of the cardiovascular system. Heart failure.
2. Pathological physiology of the external respiration system.
3. Pathological physiology of digestion and liver.
4. Pathological physiology of the kidneys.
5. Pathological physiology of the endocrine system.
6. Pathological physiology of the nervous system.

## LIST OF PRACTICAL STUDIES

### 5th semester

1. Introduction to the discipline «Pathologic Physiology». Subject, tasks, methods of pathological physiology.
2. General questions of the doctrine of the disease. General etiology and pathogenesis.
3. Pathogenic effect of environmental factors on the human body. The effect of electric current on the body.
4. Pathogenic effect of environmental factors on the human body. The damaging effects of ionizing radiation to the body.
5. The role of reactivity, heredity, constitution and age in pathology development.
6. Final lesson on the section «General Nosology».
7. Pathological physiology of regional blood circulation and microcirculation. Arterial and venous hyperemia. Ischemia.
8. Pathological physiology of regional blood circulation and microcirculation. Thrombosis. Embolism. Stasis. Microcirculatory Disorders.
9. Pathophysiology of cell. Cell injury. General cell injury mechanisms. Inflammation. Vascular reaction in the focus of inflammation.
10. Inflammation. Phagocytic reaction in the focus of inflammation.
11. Pathophysiology of thermoregulation. Fever and hyperthermia.
12. Typical violation of metabolism. Acid-base balance impairments.
13. Typical violation of metabolism. Pathological physiology of water metabolism. Swelling and dropsy.
14. Hypoxia.
15. Pathological physiology of tissue growth. Etiology of tumors. Mechanisms of carcinogenesis.
16. Final Lesson on the section «Typical pathological processes».

**6th semester**

1. Pathological physiology of the blood system. Typical forms of pathology and reactive changes in the erythrocyte system.
2. Pathological physiology of the blood system. Anemia. Erythrocytosis.
3. Pathological physiology of the blood system. Typical forms of pathology and reactive changes in the leukocyte system. Leukocytosis, leukopenia and agranulocytosis.
4. Pathological physiology of the blood system. Hemoblastosis. Leukemoid reactions.
5. Pathological physiology of the blood system. Hemostasis disorders.
6. Pathological physiology of the blood system. Changes in the total blood volume: hypo- and hypervolemia. Acute blood loss.
7. Final Lesson on the topic «Pathological physiology of Blood System».
8. Pathological physiology of the cardiovascular system. Heart failure, its types. Overload and myocardial forms of the heart failure.
9. Pathological physiology of the cardiovascular system. Heart rate disorders (arrhythmias), types, causes, mechanisms.
10. Pathological physiology of the cardiovascular system. Violations of the vascular tone regulation. Arterial hypertension and hypotension. Types, etiology and pathogenesis.
11. Final lesson on the section «Pathological physiology of the cardiovascular system».
12. Pathological physiology of the external respiration.
13. Pathological physiology of the digestive system and liver.
14. Pathological physiology of the kidneys.
15. Pathological physiology of the endocrine system.
16. Pathological physiology of the nervous system.

**PROTOCOL AGREEMENT OF EDUCATIONAL PROGRAM**

Title of the discipline requiring approval	Department	Amendments to the curriculum in the academic discipline	Decision of the department, which designed the curriculum (date, protocol # )
1. Occupational diseases	1st Department of Internal Diseases.	no	Protocol № 11 of 19.05.2023
2. Pediatrics	2nd Department of Children's Diseases	no	Protocol № 11 of 19.05.2023
3. Infectious diseases	Infectious diseases	no	Protocol № 11 of 19.05.2023
4. Internal diseases	Cardiology and Internal Medicine	no	Protocol № 11 of 19.05.2023
5. Forensic medicine	Forensic medicine	no	Protocol № 11 of 19.05.2023
6. Neurology and neurosurgery	Nervous and neurosurgical diseases	no	Protocol № 11 of 19.05.2023
7. Clinical pharmacology	Clinical pharmacology	no	Protocol № 11 of 19.05.2023
8. Surgical diseases	Surgical diseases	no	Protocol № 11 of 19.05.2023
9. Oncology	Oncology	no	Protocol № 11 of 19.05.2023
10. Endocrinology	Endocrinology	no	Protocol № 11 of 19.05.2023

## COMPILERS/AUTHORS:

Head of the Pathological Physiology  
Department of Educational Institution  
«Belarusian State Medical University»,  
PhD, MD, Professor, Corresponding  
Member of National Academy of  
Sciences of the Republic of Belarus

F.I.Vismont

Associate Professor of the Pathological  
Physiology Department of Educational  
Institution «Belarusian State Medical  
University», PhD

S.A.Zhadan

Curriculum content, composition and the accompanying documents comply with the  
established requirements

Dean of the Medical Faculty for  
International Students of the educational  
institution «Belarusian State Medical  
University»

26.06. 2023

O.S.Ischutin

Methodologist of the educational  
institution «Belarusian State Medical  
University»

26.06. 2023

S.V.Zaturanova