

**MINISTRY OF SCIENCE AND HIGHER EDUCATION
RUSSIAN FEDERATION**

**FEDERAL STATE AUTONOMOUS EDUCATIONAL INSTITUTION
OF HIGHER EDUCATION
NORTH-CAUCASUS FEDERAL UNIVERSITY**

Methodological Guidelines
for Students on arranging and performing independent work
in the Discipline of **Pathophysiology, clinical pathophysiology**
for Students majoring (Specialty) in 31.05.01 General Medicine

Methodological Recommendations for Studying Theoretical Material

When performing the independent study of theoretical material, the student must follow the rules as set below. The working curriculum of the respective academic discipline shall be recommended to be used as the basis for such activity. According to the schedule of classroom lessons and independent work, a different number of hours is to be allocated for studying individual topics. A significant portion of the student's independent work should be allocated to mastering the material on the covered topic, writing a summary (notes) on the specified theoretical blocks, and searching for additional literature based on the NCFU library and via the Internet system. The lecture material shall not cover all theoretical material; the greater part of it must be mastered through independent work. Given the above, working with the recommended literature is mandatory. Special attention must be paid to the content of the main provisions and conclusions, the explanation of phenomena and facts, and the understanding of the practical application of the theoretical issues under consideration. In the process of this work, the student should strive to understand and memorize the main provisions of the material being considered, the examples illustrating it, as well as to understand the illustrative material. Preparation should be completed by drawing up a plan (summary/notes) on the material (issue) being studied. This allows for the creation of a concentrated, concise representation of the issues being studied. First, studying the recommended literature is to be done. Special attention must be paid to the content of the main provisions and conclusions, the explanation of phenomena and facts, and the understanding of the practical application of the theoretical issues under consideration.

During this work, the student should strive to understand and memorize the main provisions of the material being considered, the examples illustrating it, as well as to understand the illustrative material. Preparation should be completed by drawing up a plan (summary/notes) on the material (issue) being studied. This allows for the creation of a concentrated, concise representation of the issues being studied. If necessary, one should seek (advice) consultation from the instructor. When going to a consultation, it is necessary to thoroughly think through the questions that require clarification. Keeping records contributes to turning reading into an active process, mobilizing motor memory along with visual memory. The following should be born in mind: a student who systematically keeps records creates their own individual stock of auxiliary materials for a quick review of what has been read and for the mobilization of accumulated knowledge. Records are especially important and useful when they reflect the thoughts that arose during independent work.

It is important to develop the students' capacity to compare sources and to think through the material being studied.

Improving note-taking skills among students is of great importance.

The instructor may recommend the following main forms of recording to students: a plan (simple and detailed), excerpts, and theses (abstracts).

The results of note-taking can be presented in various forms.

- A plan is an outline of the read material, a brief (or detailed) list of questions reflecting the structure and sequence of the material.
- A detailed plan fully replaces a summary.
- A summary (notes) is a systematized, logical presentation of the source material. Four types of summaries are distinguished:
 - Outline-summary (Plan-notes) – this is an expanded, detailed plan in which sufficiently detailed records are provided for those points of the plan that need explanation.
 - Textual summary – this is the reproduction of the most important provisions and facts of the source.

- Free summary – these are clearly and briefly formulated (stated) main provisions resulting from a deep understanding of the material. It may contain excerpts, quotations, and theses; part of the material may be represented by a plan.
- Theme-based summary – this is compiled on the basis of studying a number of sources and gives a more or less exhaustive answer according to a certain scheme (issue).

Methodological Guidelines for the Preparation for Practical Activities

When preparing for practical activities, the recommendation implies studying the control questions for the given lesson and the theoretical material from one's own notes.

The main form of work during the lessons is an interview (discussion). Each student must be ready to speak on all issues raised in the plan and demonstrate maximum activity during their consideration.

The speech must be constructed freely, convincingly, and with arguments. The instructor ensures that the speech is not reduced to a reproductive level (simple reproduction of the text); simple reading of the summary is also not allowed.

It is necessary for the speaker to show their own attitude towards what they are talking about, express their personal opinion and understanding, substantiate it, and be able to draw the correct conclusions from what has been said. In doing so, the student may refer to the entries in the summary, directly to the primary sources, use knowledge of previously studied disciplines, etc. In addition, to obtain a grade at an advanced level, students solve situational tasks based on the results of the mastered topics.

During the execution of practical works, a defense of practical skills is provided, the full list of which is specified in the fund of assessment tools.

Methodological Recommendations for the Preparation of Presentations and Reports

The report must contain elements of novelty; along with the fundamental aspect, an analysis of the current state of the problem under study must be carried out, as well as inclusion in regional issues. The report must include an introduction, a theoretical part, a conclusion, a list of literature, and a presentation that reveals the essence of the topic in graphs, pictures, diagrams, and formulas.

The report is recommended to be submitted on 1 printed sheet. The text of the work must be printed with 1.5 line spacing on one side of a standard sheet (A4) of white paper.

The text and other printed elements of the work must be black, and the contours of letters and signs must be clear, without halos and shading. The font must be Times New Roman, size 14. The titles of chapters and paragraphs are highlighted in bold. The sheet with text must have margins: left – 30 mm, right – 10 mm, top – 20 mm, bottom – 20 mm.

Page numbering of the text is done in the lower right corner of the sheet. It is necessary to number pages starting from the page where the Introduction is printed, on which the number 3 is placed. After that, all pages, including appendices, are numbered.

A space equal to two intervals is placed between the title of the chapter and the title of the paragraph of this chapter, and the title of the paragraph must not be separated from the text of this paragraph by a space. The titles of paragraphs shall be separated from the text of the previous paragraph by a space equal to two intervals. Each chapter, as well as the introduction, conclusions, appendices, and the list of used literature, begin on a new page. The word Chapter is not to be written. Chapters have ordinal numbers within the entire work, designated by Arabic numerals (for example: 1, 2, 3), followed by a period.

The word **PARAGRAPH** or the paragraph symbol (§) is not placed in the title. Paragraphs have ordinal numbers within the chapters, designated by Arabic numerals (for example: 1.1. and 1.2.).

Headings of chapters and paragraphs in the text must be centered; a period shall not be placed at the end of the title of the chapter and paragraph. It is not allowed to hyphenate (transfer) a part of a word in a heading. 4.5. The numbering of tables and figures can be running (continuous) or relate to the number of the chapter and paragraph. For example, if a table or a figure is included in the text of the first paragraph of the second chapter, the numbering is as follows: Table 2.1.1., Fig. 2.1.1.

The last digit means the ordinal number of the table (or figure) in this paragraph.

The table is to be placed as the next page after the first mention of it in the text.

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Federal State Autonomous Educational Institution
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METHODOLOGICAL GUIDELINES

for laboratory classes

in the discipline "PATHOPHYSIOLOGY, CLINICAL PATHOPHYSIOLOGY"

for students of specialty 31.05.01 General medicine

INTRODUCTION

The aim of studying the discipline "Pathophysiology, Clinical Pathophysiology" is to develop in students the ability to effectively solve professional medical problems based on pathophysiological analysis of data on pathological processes, clinical syndromes, and diseases, using knowledge of the general patterns of their origin, development, and outcomes, as well as to formulate principles (algorithms, strategies) and methods for their detection (diagnosis), treatment, prevention, and rehabilitation.

Objectives of the discipline:

- To study the molecular, cellular, tissue, organ, systemic, and intersystem mechanisms of typical pathological processes;
- To investigate the causes, mechanisms of development, principles of detection, treatment, prevention, and outcomes of specific diseases affecting individual organs and systems;
- To analyze the nature of clinical manifestations of major pathological processes;
- To train students in formulating principles (algorithms, strategies) and methods for identifying, treating, and preventing pathological processes, conditions, reactions, and diseases;
- To develop the ability to perform pathophysiological analysis of data on pathological processes, clinical syndromes, typical pathological conditions, and individual diseases;
- To familiarize students with the principles of pathogenetic therapy for diseases of individual organs and systems;
- To develop methodological and practical skills in clinical reasoning and rational decision-making in medical practice.

Upon completion of the discipline, the student must know:

- The main pathological conditions, symptoms, and syndromes of nosological disease entities in accordance with the International Statistical Classification of Diseases and Related Health Problems (ICD). Modern theories of disease development, etiopathogenesis, and diagnostic principles;
- The patterns of regulation of functional systems of the human body under pathological conditions;
- The principal pathological conditions, symptoms, and syndromes of nosological disease forms according to the international classification of diseases.

The student must be able to:

- Diagnose syndromocomplexes and assess pathophysiological processes in the body for a given nosological entity;
- Diagnose syndromocomplexes and evaluate pathophysiological processes in the body for a given nosological entity.

The student must master:

- Methods of analyzing clinical syndromes; justification of pathogenetic and evidence-based diagnostic methods; the diagnostic algorithm;
- Methods of analyzing clinical syndromes;
- Skills in studying pathological processes in the human body for solving professional tasks;
- Skills in justifying pathogenetic and evidence-based diagnostic methods; the diagnostic algorithm.

TOPIC 1. GENERAL PATHOPHYSIOLOGY

Laboratory Work No. 1–2 General Pathophysiology. General Nosology

Review Questions:

1. The subject matter and objectives of pathophysiology; its interrelation with other biomedical disciplines. The role of pathophysiology in medical education.
2. A brief historical overview of pathophysiology. Major stages in its development. Contributions of I.M. Sechenov, I.P. Pavlov, I.I. Mechnikov, V.V. Pashutin, A.B. Fokht, A.A. Bogomolets, N.N. Anichkov, S.S. Khalatov, G.P. Sakharov, P.D. Gorizontov, P.N. Veselkin, A.M. Filomafitsky, R. Virchow, J. Cohnheim, C. Bernard, W. Cannon, H. Selye, and other prominent researchers to the development of pathophysiology.
3. Structure of the pathophysiology course: general pathological physiology (general nosology; typical pathological processes); special pathological physiology (pathophysiology of organ systems).
4. General nosology. Definitions of "health" and "disease". Stages of disease and their characteristics. Outcomes of disease. The concept of disease as a unity of pathological alterations and protective-compensatory responses. Principles of disease classification.
5. Definitions of pathological reaction, pathological process, and pathological condition.
6. Significance of studying etiology, pathogenesis, and sanogenesis. The role of causes and conditions in the development of diseases and pathological processes. The concept of the leading link in pathogenesis, "vicious circles," and etiotropic versus pathogenetic treatment approaches.
7. Methods of pathological physiology. The experiment as the primary method. Acute and chronic experiments. Moral and ethical aspects of animal experimentation.

Laboratory Work No. 3–4. Reactivity

Review Questions:

1. Reactivity. Types of reactivity (species-specific, group-specific, individual). Physiological versus pathological reactivity. Specific and nonspecific mechanisms of reactivity.
2. Hypoergia, normoergia, and hyperergia. Characteristics.
3. Resistance. Mechanisms of resistance. Local versus systemic resistance; innate versus acquired resistance.
4. Interrelation between reactivity and resistance. The influence of heredity, constitution, sex, age, external environmental factors, social determinants, etc., on the level of reactivity and resistance.
5. Stress as a manifestation of reactivity. Phases of stress. Changes in resistance during stress. Types of stress. The concept of anti-stress immunity. Biological significance of stress.

Laboratory Work No. 5–6. Pathophysiology of the Cell

Review Questions:

1. Cell injury. Types of injury. Mechanisms of cell damage.
2. Causes and consequences of impaired energy production in the cell.

3. Damage to the membrane apparatus and enzyme systems of the cell. Oxidative stress as a universal mechanism of cell injury. Causes and mechanisms of oxidative stress. Mechanisms of antioxidant defense.

4. Distribution of electrolytes in intracellular and extracellular fluid. The role of ions in cellular function. Causes and consequences of ionic and water imbalance in the cell.

5. Major pathways of signal transduction into the cell. Mechanisms of intercellular signaling. The role of eicosanoids, hormones, and growth factors in the regulation of cellular functions.

6. Intracellular mechanisms regulating cell function. The concept of second messengers. The role of calcium in cellular function and injury.

7. Consequences of damage to cellular organelles: plasma membrane, nucleus, mitochondria, ribosomes, lysosomes, Golgi apparatus, peroxisomes, and cytoskeleton.

8. Apoptosis. Sequence of ultrastructural changes in apoptosis. Pathways of apoptosis initiation. Stages of apoptosis.

9. Consequences of excessive or insufficient apoptosis. Comparative characteristics of necrosis and apoptosis.

10. Mechanisms of cellular protection and adaptation under injurious stimuli. Strategies to enhance cell resistance to pathogenic factors and stimulate reparative processes in damaged cells.

Laboratory Work No. 7–8. Disorders of Local Circulation

Review Questions:

1. Definition of peripheral circulation and microcirculation. Factors determining blood flow and transcapillary exchange in organs and tissues.

2. Mechanisms regulating peripheral circulation (neural, humoral, hormonal, metabolic). The role of the endothelium.

3. Classification of peripheral circulatory disorders.

4. Arterial hyperemia. Causes, types, mechanisms of development, hemodynamic features, clinical signs, and consequences.

5. Venous hyperemia. Causes, types, mechanisms of development, hemodynamic features, clinical signs, and consequences.

6. Ischemia. Causes, mechanisms of development, hemodynamic features, clinical signs, and consequences. The role of endothelial dysfunction in the pathogenesis of ischemia.

7. Factors influencing the outcome of ischemia. The concept of preconditioning.

8. Mechanisms of ischemic brain injury. Zones of cerebral ischemia.

9. Post-ischemic reperfusion syndrome. Causes and pathogenesis. The "no-reflow" phenomenon.

10. Stasis. Types. Causes. Consequences.

11. Disorders of blood rheological properties. The "sludge" phenomenon. Causes, consequences, and prevention of irreversible changes.

Laboratory Work No. 9–10. Inflammation

Review Questions:

1. Definition of inflammation. Exogenous and endogenous causes. The role of infectious agents in the inflammatory process.

2. Alteration: definition, types, causes. Zones of alteration.

3. Metabolic and physicochemical changes in the inflammatory focus.

4. Inflammatory mediators and their role in the development of inflammation.

5. Phases of microcirculatory disturbances in the inflammatory focus: mechanisms of development and their significance.
6. Exudation. Factors promoting exudation. Types of exudative inflammation. Characteristics. Biological significance of exudation.
7. Leukocyte emigration. Stages and mechanisms. The role of integrins and selectins.
8. Phagocytosis. Stages of phagocytosis. The role of opsonins. Bactericidal and digestive systems of leukocytes. The concept of the "respiratory burst." Factors activating and inhibiting phagocytosis. The concept of exophagocytosis.
9. Reparative processes in the inflammatory focus. Proliferation and regeneration. Stages of proliferation. Factors stimulating proliferation and regeneration. Correlation between proliferation and regeneration.
10. The interrelationship of alteration, circulatory disorders with exudation, leukocyte emigration, and reparative processes in inflammation.
11. Local signs and systemic manifestations of acute inflammation and their underlying mechanisms.
12. Chronic inflammation. Causes. Differences from acute inflammation in pathogenesis.
13. Classification of inflammation (by reactivity, duration, predominant phase) and their characteristics.
14. Principles of anti-inflammatory therapy.
15. Outcomes of inflammation. Factors influencing the outcomes.
16. Biological role of inflammation. The balance between damage and protective mechanisms in inflammation. Specific features of inflammation in children.

Laboratory Work No. 11–12. Pathology of Body Temperature Regulation

Review Questions:

1. Disorders of thermoregulation. Fever. Infectious and non-infectious fevers.
2. Etiology of infectious fever. Primary and secondary pyrogens: comparative characteristics and their role in fever development.
3. Pathogenesis of fever. The role of the hypothalamus and the autonomic nervous system.
4. Stages of fever and their characteristics. Mechanisms of changes in heat production and heat dissipation.
5. Metabolic and functional changes in the body during fever.
6. Biological significance of fever. The concept of pyrogen therapy. Commercial pyrogens. Phylogenetic and ontogenetic aspects of fever.
7. Principles of antipyretic therapy. Types of fever curves and their features during antibacterial treatment.
8. Specific features of fever in pediatric and geriatric patients.
9. Systemic effects of endotoxins. The concept of systemic inflammatory response syndrome (SIRS). Septic shock.
10. Hyperthermia. Causes and mechanisms of pathogenic effects on the body. Heat stroke and sunstroke. Differences between hyperthermia and fever.
11. Hypothermia. Causes, mechanisms of pathogenic effects. Therapeutic hypothermia and its clinical applications.

Laboratory Work No. 13–14. Typical Metabolic Disorders

Review Questions:

1. Biological role of carbohydrates in the body. Major stages of carbohydrate metabolism.
2. Causes and consequences of impaired carbohydrate digestion and absorption in the gastrointestinal tract. Disaccharidase (lactase) deficiency.
3. Mechanisms of blood glucose regulation. The role of hormones.
4. Insulin: chemical structure and biological functions.
5. Hyperglycemia: etiopathogenesis.
6. Diabetes mellitus. Types and their characteristics. Etiology of diabetes mellitus.
7. Metabolic disturbances in diabetes mellitus. Oral glucose tolerance test in the diagnosis of diabetes.
8. Major clinical symptoms of diabetes mellitus and the mechanisms of their development.
9. Complications of diabetes mellitus. General characteristics.
10. Diabetic comas (ketoacidotic, hyperosmolar, lactic acidemic). Pathogenesis.
11. Vascular complications of diabetes mellitus (micro- and macroangiopathies). Pathogenesis. Clinical manifestations.
12. Hypoglycemia: etiopathogenesis. Hypoglycemic coma.
13. Disorders of glycogen synthesis and degradation. Glycogenoses.
14. Pathology of water-soluble and fat-soluble vitamin metabolism.
15. Atherosclerosis. Metabolic prerequisites and consequences. Pathogenesis. Modifiable and non-modifiable risk factors.
16. Obesity. Classification by etiology and pathogenesis, and by degree. Body mass index (Quetelet index). Consequences of obesity. Causes of wasting.
17. Fatty infiltration and fatty degeneration of organs. Causes and mechanisms.
18. The concept of nitrogen balance. Causes of imbalance.
19. Protein-energy malnutrition. Causes and systemic consequences.
20. Disorders of protein digestion and absorption in the gastrointestinal tract. Causes and consequences. Celiac disease.
21. Causes and consequences of disorders of intermediate amino acid metabolism (deamination, transamination, decarboxylation).
22. Causes and mechanisms of impaired protein synthesis in tissues.
23. Dysproteinemias: classification, causes, and consequences.
24. Hyperazotemia: types and characteristics.
25. Disorders of nucleic acid metabolism. Gout: etiology and pathogenesis.
26. Starvation. Types. Stages of complete starvation. Metabolic and functional changes during complete starvation. Principles of refeeding.
27. Therapeutic fasting.
28. Prospects for the use of amino acids as therapeutic agents.
29. Regulation of water-electrolyte balance. Fundamental principles. The role of aldosterone, vasopressin, atrial natriuretic peptide, and other hormones. The renin-angiotensin-aldosterone system.
30. Types of water-electrolyte imbalance. General characteristics. Systemic consequences.
31. Dehydration: hyperosmolar, hypo-osmolar, and iso-osmolar types. Causes, mechanisms, and consequences.
32. Fluid overload: hyperosmolar, hypo-osmolar, and iso-osmolar overhydration. Water intoxication. Causes, mechanisms, and consequences.

33. Principles of therapy for various types of dehydration and overhydration.
34. Edema. Pathogenetic factors involved in edema formation. Classification by etiology.
35. Disorders of sodium, potassium, chloride, calcium, magnesium, and phosphate metabolism.
36. Disorders of trace element metabolism (copper, iodine, manganese, selenium, etc.).
37. Acid-base status: definition. Mechanisms of regulation. Buffer systems.
38. The role of the lungs, kidneys, and other organs in maintaining acid-base balance.
39. Parameters characterizing acid-base status. Methods of assessment.
40. Acid-base disorders: acidosis and alkalosis. Compensated versus decompensated states. Functional changes in the body.
41. Causes, mechanisms of development and compensation, acid-base parameters, and therapeutic approaches for:
 - a) Metabolic (non-respiratory) acidosis;
 - b) Respiratory acidosis;
 - c) Metabolic alkalosis;
 - d) Respiratory alkalosis.

Laboratory Work No. 15–16. Pathophysiology of Immunity. Allergy

Review Questions:

1. Pathology of immunological reactivity. Immunodeficiency states: classification and systemic consequences. Immunological tolerance.
2. Immune reactivity in childhood. Primary (hereditary) immunodeficiencies: severe combined immunodeficiency (SCID), DiGeorge syndrome, Nezelof syndrome, Bruton's disease, Chediak-Higashi syndrome, and others.
3. Secondary (acquired) immunodeficiency states: causes and mechanisms.
4. AIDS: etiology, pathogenesis, clinical manifestations, stages.
5. Graft-versus-host disease (GVHD): causes and clinical features.
6. *Adaptation. Diseases of adaptation.
7. Allergy. Causes of the increasing prevalence of allergic diseases. Genetic predisposition.
8. Allergens: classification and characteristics. Differences between allergens and antigens.
9. Sensitization. Types.
10. Pathogenesis of allergic reactions: immunological, pathochemical, and pathophysiological stages.
11. Mediators of immediate-type and delayed-type hypersensitivity.
12. Gell and Coombs classification of hypersensitivity reactions.
13. Anaphylactic shock in humans: clinical variants. Experimental models of anaphylaxis.
14. Characteristics of immediate-type allergic diseases: pollinosis, serum sickness, bronchial asthma, Quincke's edema.
15. Desensitization: specific and non-specific mechanisms.
16. Local anaphylaxis (Arthus phenomenon, etc.).
17. Pseudoallergic reactions. Cross-allergy.
18. Autoimmune diseases: mechanisms of development.

Laboratory Work No. 17–18. Tumors. Pathogenesis of Neoplastic Growth

Review Questions:

1. Definitions of "tumor growth" and "tumor." Prevalence of tumors in nature, phylogenesis, and ontogenesis.
2. Etiology of tumors: physical and chemical blastomogenic factors; biological carcinogens.
3. Chemical carcinogens: classification. Procarcinogens and ultimate (true) carcinogens. Cocarcinogens and syncarcinogens. Stages of chemical carcinogenesis. Physical carcinogens.
4. Ionizing radiation as a blastogenic factor. The role of ionizing radiation, radioisotopes, ultraviolet radiation, X-rays, thermal and mechanical factors.
5. Stages of physical carcinogenesis. Biological carcinogens.
6. Types of oncogenic viruses. Stages of viral carcinogenesis.
7. The role of hereditary factors, sex, age, and chronic diseases in tumor development in humans.
8. Biological characteristics of tumor growth: relative autonomy and unregulated growth; simplification of structural and chemical organization (atypia, its types); similarities and differences between tumors and embryonic tissues.
9. Metastasis: definition, stages, and mechanisms. Tumor recurrence.
10. Benign versus malignant tumors: growth characteristics. Metabolic, antigenic, and functional properties of malignant cells. Mechanisms of invasive and destructive growth.
11. Tumor progression.
12. Theories of carcinogenesis. Modern concepts of molecular-genetic mechanisms. Proto-oncogenes and tumor suppressor genes (antioncogenes) and their role in oncogenesis. Mechanisms of proto-oncogene activation into oncogenes.
13. Nature of oncoproteins and their mechanisms of action. The role of mutational, epigenomic, and virus-genetic mechanisms in carcinogenesis.
14. Precancerous conditions.
15. Antiblastic resistance of the organism: immune and non-immune factors. The significance of reduced antiblastic resistance in tumor development.
16. Tumor-host interaction. The role of the nervous and endocrine systems. Systemic manifestations of neoplastic disease. Tumor cachexia.
17. Pathophysiological basis of cancer prevention and therapy.

Laboratory Work No. 19–20–21–22. Pathophysiology of the Blood System

Review Questions:

1. Disorders of total blood volume. Classification (based on circulating blood volume and hematocrit).
2. Normovolemia: types, causes, and consequences.
3. Hypervolemia: types, causes, and consequences.
4. Hypovolemia: types, causes, and consequences.
5. Blood loss: types and causes.
6. Pathogenesis of disorders and main clinical manifestations in acute blood loss.
7. Stages of compensation in acute blood loss.
8. Dynamics of erythrocyte count, hemoglobin, and hematocrit after acute blood loss. Peripheral blood picture.
9. Objective criteria for assessing the severity of blood loss.
10. Factors influencing the outcome of blood loss.

11. Hemorrhagic shock.
12. Principles of therapy for blood loss. The role of plasma expanders.
13. Erythrocyte and hemoglobin parameters in adults and children. Calculated erythrocyte indices.
14. Erythropoiesis: stages.
15. Erythrocytoses: classification and characteristics. Polycythemia vera (Vaquez's disease).
16. Anemias: general clinical symptoms and their underlying mechanisms.
17. Classifications of anemias (by etiopathogenesis, severity, type of hematopoiesis, color index, regenerative capacity, erythrocyte size, etc.).
18. Posthemorrhagic anemias. Peripheral blood picture in acute versus chronic posthemorrhagic anemia.
19. Iron-deficiency anemias: etiology and pathogenesis. Iron-redistribution and sideroachrestic anemias. Sideropenic syndrome. Peripheral blood picture.
20. Etiology and pathogenesis of B12-deficiency (Addison-Biermer disease) and folate-deficiency anemias. Peripheral blood picture. Pathogenesis of major syndromes.
21. Hypo- and aplastic anemias: etiology, pathogenesis, diagnosis.
22. Hemolytic anemias: acquired and hereditary. Causes and mechanisms. Clinical manifestations. Peripheral blood picture.
23. Hereditary hemolytic anemias: membranopathies, hemoglobinopathies, enzymopathies.
24. Hemolytic disease of the newborn: etiopathogenesis and prevention.
25. Leukocytes: functions of different types. The concept of the leukon.
26. Stages of leukocyte development. Characteristics at different stages.
27. Leukocyte differential count. Age-related features in children. Abnormalities in the differential count. Clinical significance.
28. Leukocytosis: types, causes, and mechanisms. Qualitative changes in leukocytes.
29. Causes and mechanisms of neutrophilic leukocytosis.
30. The concept of the "shift to the left" (nuclear shift) in neutrophils: types and causes. The nuclear shift index (NSI) and its significance.
31. Causes and mechanisms of eosinophilic, basophilic, lymphocytic, and monocytic leukocytosis.
32. Leukopenia: types, causes, and mechanisms. Systemic consequences.
33. Agranulocytosis: consequences for the body.
34. Leukemia: etiology. Modern theories of leukemogenesis. Pathogenesis.
35. Characteristics of leukemic cells.
36. Classification of leukemias (acute and chronic).
37. Peripheral blood morphology in acute and chronic myeloid and lymphoid leukemias.
38. Main clinical forms of leukemias. Pathogenesis of anemia and hemorrhagic syndrome in leukemia.
39. Leukemoid reactions: types, causes, and pathogenesis. Differences from leukemia.
40. Principles of diagnosis and therapy of leukemias.

Laboratory Work No. 23–24. Pathophysiology of the Cardiovascular System

Review Questions:

1. Circulatory failure: general characteristics.
2. Types of circulatory failure (acute vs. chronic; left-sided vs. right-sided heart failure).
3. Major hemodynamic parameters characterizing acute and chronic circulatory failure.

4. Clinical symptoms of circulatory failure and the mechanisms underlying them.
5. Mechanisms of blood pressure regulation. Types of blood pressure disorders.
6. Hypertension: degrees of severity and stages.
7. Pathogenesis of essential hypertension. Risk factors. The role of endothelial dysfunction.
8. Symptomatic arterial hypertension: renal (renovascular, renoprival) hypertension.
9. Clinical manifestations and complications of hypertension.
10. Experimental models of hypertension.
11. Pulmonary hypertension.
12. Hypotension: types and causes.
13. Blood pressure disorders in children. Neurocirculatory dystonia.
14. Mechanisms of cardiac rhythm generation. Causes of arrhythmias.
15. Classification of cardiac arrhythmias. Mechanisms.
16. Disorders of automaticity: types, etiopathogenesis.
17. Disorders of excitability: mechanisms and types.
18. Conduction disorders: heart blocks. Types, causes, and mechanisms.
19. Consequences of cardiac arrhythmias for the body.
20. Disorders of rhythm assimilation.

Laboratory Work No. 25–26. Pathophysiology of the Heart

Review Questions:

1. Coronary heart disease: etiopathogenesis. Stunned myocardium and hibernating myocardium. Myocardial infarction. Causes of death in myocardial infarction. Post-ischemic preconditioning.
2. Non-coronary causes of myocardial injury.
3. Types and characteristics of overload-induced heart failure.
4. Mechanisms of compensation in heart failure: cardiac and extracardiac mechanisms. Heterometric (Frank-Starling) and homeometric compensation. Decompensation.
5. Myocardial hypertrophy: stages according to F.Z. Meerson.
6. Hemodynamic changes in valvular heart disease (valve insufficiency and stenosis).

Laboratory Work No. 27–28. Pathophysiology of External Respiration

Review Questions:

1. Respiratory failure: causes. The role of smoking. Systemic consequences.
2. Indicators of respiratory failure: lung volumes and capacities; blood gas changes.
3. Disorders of alveolar ventilation: types and characteristics.
4. Obstructive ventilation disorders: causes and consequences of impaired nasal breathing, laryngeal, tracheal, and bronchial function.
5. Pathogenesis of bronchial obstruction in asthma. The Tiffeneau index (FEV1/FVC ratio).
6. Restrictive ventilation disorders: characteristics.
7. Changes in lung volumes and capacities in obstructive and restrictive disorders.
8. Diffusion disorders: etiopathogenesis.
9. Perfusion disorders: characteristics and causes. The ventilation-perfusion ratio.
10. Acute and chronic respiratory failure: degrees of severity.
11. Dyspnea: types and mechanisms.
12. Pathological and periodic breathing patterns: pathogenesis.

13. Etiology, pathogenesis, and respiratory function impairment in pneumonia, atelectasis, and emphysema.
14. Pneumothorax: types and characteristics.
15. Pulmonary edema: cardiac and non-cardiac causes. Pathogenesis. Respiratory distress syndrome.
16. Pulmonary hypertension.
17. Asphyxia: stages, mechanisms, and pathological breathing patterns.
18. Disorders of non-respiratory functions of the lungs.

Laboratory Work No. 29–30. Pathophysiology of the Gastrointestinal Tract

Review Questions:

1. The role of the digestive system. Gastrointestinal hormones and their functions.
2. Etiology of gastrointestinal diseases. The role of alcohol, smoking, and other factors.
3. Appetite disorders: anorexia, hyperorexia, bulimia, polyphagia. Causes.
4. Disorders of digestion in the oral cavity: mastication, salivation, swallowing. Causes and consequences. Dental caries: etiopathogenesis and prevention.
5. Esophageal dysfunction: achalasia of the cardia.
6. Types of gastric secretion. Quantitative and qualitative disorders. Achlorhydria. Achylia.
7. Disorders of gastric motility and evacuation: belching, heartburn, nausea, vomiting.
8. Gastritis. Peptic ulcer of the stomach and duodenum; symptomatic gastric ulcers. Etiopathogenesis (the "balance theory"). The role of stress and *Helicobacter pylori*.
9. Experimental models of gastric and duodenal ulcers. Principles of pathogenetic therapy.
10. Disorders of intestinal digestion. Maldigestion and malabsorption syndromes. Constipation and diarrhea. Consequences.
11. Intestinal dysbiosis: causes and consequences.
12. Intestinal obstruction: types and pathogenesis.
13. Pancreatitis: etiopathogenesis. Pancreatic collapse.
14. Anatomical and physiological features of the liver and biliary tract.
15. Assessment of liver function: experimental and clinical methods. Functional tests.
16. Hepatitis. Cirrhosis. Fatty liver disease. The role of alcohol and other factors.
17. Liver failure: causes and stages. Characteristics.
18. Hepatic coma: types, symptoms, and mechanisms. Principles of therapy. Hemosorption. Liver transplantation.
19. Portal hypertension: causes. Suprahepatic, hepatic, and infrahepatic portal hypertension.
20. Jaundice: types. Disorders of pigment metabolism in hemolytic, hepatocellular, and obstructive jaundice.
21. Cholemia: mechanisms and manifestations. Cholestasis: causes and systemic effects.
22. Cholelithiasis: etiopathogenesis and risk factors.

Laboratory Work No. 31–32. Pathophysiology of the Kidneys

Review Questions:

1. The role of the kidneys in the body. Methods for assessing renal function. Clearance.
2. Pathogenesis of urine formation disorders: impaired filtration, reabsorption, secretion, and excretion.

3. Causes and mechanisms of diuresis disorders: oliguria, anuria, polyuria. Hyposthenuria, isosthenuria, hypersthenuria. Causes.

4. Abnormal urinary composition. Pathological components of urine reflecting renal and systemic disorders.

5. Acute and chronic diffuse glomerulonephritis: etiology, pathogenesis, and clinical manifestations. Mechanisms of hypertension and edema in nephritis.

6. Nephrotic syndrome: pathogenesis and clinical features. Mechanisms of edema.

7. Pyelonephritis: etiopathogenesis and characteristics.

8. Acute renal failure: etiology, pathogenesis, and stages.

9. Chronic renal failure. Uremia. Hemodialysis (artificial kidney).

10. Urolithiasis: factors and mechanisms promoting stone formation.

11. Consequences of impaired non-excretory renal functions.

Laboratory Work No. 33–34. Pathophysiology of the Endocrine System. General Mechanisms of Endocrine Disorders

Review Questions:

1. Hierarchy of the endocrine system. Regulation of endocrine function. Hormone chemistry and mechanisms of action. Releasing factors.

2. Central, glandular, and peripheral mechanisms of endocrine disorders. Iatrogenic endocrinopathies.

3. Classification of endocrinopathies: central (secondary and tertiary) versus peripheral (primary).

4. Pathology of the hypothalamic-pituitary system. Hypothalamic disorders. Adenohypophysis pathology. Hyperfunction: diseases caused by excess growth hormone. The role of somatomedins.

5. Partial and total pituitary insufficiency: Sheehan's syndrome, Simmonds' disease. Main disorders and symptoms.

6. Diabetes insipidus. Syndrome of inappropriate ADH secretion. Pahrn's syndrome.

Laboratory Work No. 35–36. Pathophysiology of the Thyroid, Adrenal, Parathyroid, and Gonadal Glands

Review Questions:

1. Adrenal pathology. Adrenal cortex hypofunction: acute and chronic adrenal insufficiency. Addison's disease: causes and pathogenesis.

2. Adrenal cortex hyperfunction: primary and secondary aldosteronism. Pathogenesis and symptoms.

3. Itsenko-Cushing's disease and syndrome: etiopathogenesis and clinical features.

4. Adrenogenital syndrome: mechanisms and manifestations.

5. Adrenal medulla pathology: pheochromocytoma.

6. Thyroid pathology: classification of disorders (central and peripheral hyperthyroidism).

7. Hyperthyroidism: Graves' disease (Basedow's disease). Etiopathogenesis, symptoms, and their pathophysiological basis.

8. Hypothyroidism: myxedema, cretinism, endemic goiter. Etiopathogenesis and clinical features.

9. Hyper- and hypoparathyroidism: causes and major disorders.

10. Gonadal pathology: biological role of estrogens and androgens. Hyper- and hypogonadism in prepubertal and adult males and females.

11. Climacteric syndrome.
12. Menstrual cycle disorders as a cause of female infertility.
13. The role of the pineal gland.

Laboratory Work No. 37–38. Pathophysiology of Nervous System Disorders

Review Questions:

1. Neuronal pathology. The concept of parabiosis. Phases of parabiosis.
2. Disorders of synaptic transmission. Effects of curare-like agents and organophosphorus compounds. Myasthenia gravis.
3. Tissue changes following denervation: denervation syndrome. Features of denervation of internal organs.
4. Motor function disorders: hypokinesia. Paralysis and paresis. Causes. Comparative characteristics of central versus peripheral paralysis. Parkinsonism.
5. Hyperkinesia: types and causes.
6. Sensory disorders: types. Patterns of sensory loss depending on the level of lesion.
7. Dissociated sensory disturbances. Brown-Séquard syndrome.
8. Pain: its biological role. Causes and mechanisms. Visceral and somatic pain: characteristics. Causalgia, phantom pain. Zakharyin-Ged zones (referred pain).
9. Pain management strategies. Nociceptive and antinociceptive systems.

Laboratory Work No. 39–40. Pathophysiology of Higher Nervous Activity

Review Questions:

1. Causes of higher nervous activity (HNA) disorders. Manifestations. The role of the generator of pathologically enhanced excitation (GPGE) and pathological systems (G.N. Kryzhanovsky).
2. Neuroses: causes. The informational triad and its role in the development of human neuroses. Experimental models.
3. Types of neuroses: Pavlov's classification. Characteristics and manifestations.
4. Prevention of neuroses.
5. Autonomic dysfunction.
6. Effects of alcohol on the body. Acute intoxication: manifestations and severity.
7. Alcohol dependence (alcoholism): stages and characteristics. Withdrawal syndrome. Korsakov's syndrome.
8. Drug addiction and substance abuse: causes, stages, and withdrawal syndrome.
9. The role of neurotransmitter imbalances in disorders of cognition, memory, emotion, and behavior.
10. Alzheimer's disease, schizophrenia, parkinsonism, and others.
11. Sleep-wake cycle disorders: causes and manifestations.
12. Pathology of the autonomic nervous system.

Laboratory Work No. 41–42. Pathophysiology of Extreme States

Review Questions:

1. Definition of "extreme states." Types: shock, collapse, coma. Causes, mechanisms, and consequences.
2. Collapse: definition and classification. Syncope.
3. Types of collapse: mechanisms and clinical features.
4. Etiological and pathogenetic principles of treatment.

5. Shock: definition and etiopathogenetic classification. Mechanisms of major shock syndromes.

6. Organ damage in shock: "shock lung," "shock kidney."

7. Traumatic shock: etiology and stages.

8. The role of neuroendocrine and humoral mechanisms in traumatic shock.

9. Clinical features of traumatic shock and severity assessment.

10. Crush syndrome (crush injury): causes and pathogenesis.

11. Cardiogenic shock: etiology.

12. Mechanisms of cardiogenic shock: reduced myocardial contractility, vascular insufficiency, microcirculatory failure, pain syndrome.

13. Clinical manifestations and pathogenetic principles of treatment.

14. Coma: definition, types, and etiology. Major pathogenetic factors.

15. Metabolic comas: definition and classification.

16. Ketoacidotic coma: etiology, pathogenesis, clinical features, and treatment.

17. Hyperosmolar coma: causes, mechanisms, clinical features, prevention, and treatment.

18. Lactic acidotic coma: causes, mechanisms, clinical features, and treatment.

19. Hypoglycemic coma: causes, mechanisms, clinical features, and treatment.

20. Chlorhydropenic coma: causes, mechanisms, clinical features, and treatment.

List of Practical Skills to Be Acquired by Students

- Ability to identify pathological blood cells in peripheral blood smears.
- Calculation and interpretation of the color index.
- Performing differential leukocyte counts, reticulocyte and platelet counts from blood smears; clinical interpretation.
- Cytological evaluation of inflammatory exudate and assessment of phagocytic activity.
- Pathogenetic analysis of hemograms in various hematological disorders. Ability to identify typical forms of blood pathology, assess the severity of changes, evaluate the functional status of the hematopoietic system, its compensatory capacity, and the reversibility of abnormalities.
- Ability to interpret experimental data on acute and chronic exposure to ionizing radiation: recognize radiation sickness, its form, long-term effects, and predict potential pathologies in the organism and offspring.
- ECG interpretation: identification of major arrhythmias and signs of myocardial necrosis.
- Assessment of ventilation parameters, blood gas analysis, and pulmonary blood flow to diagnose typical disorders of pulmonary gas exchange.
- Differentiation of pathological breathing patterns from recordings: Cheyne-Stokes, Biot, Kussmaul, gasping, and apneustic breathing.
- Evaluation of urinalysis and clearance tests to characterize typical renal function disorders.
- Differential diagnosis of jaundice types based on biochemical analyses of blood, urine, and stool.
- Recognition of portal hypertension syndrome and its classification based on clinical features.
- Interpretation of history, blood, and urine data to diagnose acid-base disorders, analyze causes and mechanisms, and propose corrective measures.

- Identification of hypoxia types based on blood gas analysis.
- Evaluation of gastric juice analysis to diagnose typical disorders of gastric secretion.
- Recognition of genetic and chromosomal disorders using external phenotypic features, sex chromatin analysis, and pedigree analysis; prediction of recurrence risk.
- Construction and interpretation of fever curves; classification of febrile responses.
- Ability to analyze experimental results, perform basic statistical processing, prepare illustrative material, and formulate conclusions.
- Justification of pathogenetic therapy principles for common diseases.
- Pathophysiological analysis of clinical-laboratory and experimental data to identify causes, mechanisms, and principles of diagnosis, treatment, and prevention.
- Interpretation of results from routine diagnostic methods.
- Solving various types of clinical case-based (situational) problems.

8. Educational, Methodological, and Informational Support for the Discipline

8.1. List of Main and Additional Literature Required for Mastering the Discipline (Module)

8.1.1. List of Main Literature:

1. Litvitsky P.F., Pinzhkov S.V., Tezikov E.B. Clinical Pathophysiology. Concise lectures, tests, cases. - GEOTAR-Media, 2019. – 432 p.
2. Litvitsky P.F., Pinzhkov S.V., Tezikov E.B. Pathophysiology: Concise Lectures, Tests, Clinico-Pathophysiological Situations and Clinico-Laboratory Cases. - GEOTAR-Media, 2025. – 376 p.

8.1.2. List of Additional Literature:

1. Hammer Gary D., McPhee Stephen J. Pathophysiology of Disease: An Introduction to Clinical Medicine 8e. - [McGraw-Hill](#), 2018. – 832 p.

8.2. List of Educational and Methodological Support for the Independent Work of Students in the Discipline (Module)

Bicheva, G.V. Methodological guidelines on the discipline "Pathophysiology, clinical pathophysiology" for students of specialty 31.05.01 General Medicine, Stavropol: NCFU (electronic version)

8.3. List of Resources of the Information and Telecommunications Network **Internet Required for Mastering the Discipline (Module)**

1. <http://rudoctor.net/> - Medical Portal
 2. <http://www.e-reading.club/> - Large Online Library
 3. <http://www.pubmed.com/> - database of full-text articles on medicine
 4. <http://www.spravocnikpolekarstvam.ru/> - free online reference guide
 5. <https://dic.academic.ru/> - Dictionaries and encyclopedias
 6. <https://www.rmj.ru/> - Russian Medical Journal
- <https://www.studentlibrary.ru/> - EBS "Student Consultant"