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Institute for Medicine, Ecology and Physical Education

T. Biktimirov`s Medicine Faculty

*T.P.Gening, T.V.Abakumova, S.O.Gening*

METHODICAL INSTRUCTIONS FOR ORGANIZING INDEPENDENT WORK OF  
STUDENTS IN THE DISCIPLINE "NORMAL PHYSIOLOGY"  
FOR SPECIALTY 31.05.01 General Medicine

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*Reviewers:*

Associate Professor at the Department of Morphology Ulsu, Ph.D ***T.I.Kuznetsova***

**Gening T.P.**

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The manual was prepared in accordance with the requirements of the work program and contains guidelines on the main sections of the discipline "Normal Physiology" in English in accordance with the current curriculum. The manual is intended for independent work of students of the medical faculty.

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## *CONTENTS*

|  |  |  |
|--|--|--|
|  | Introduction   |  |
|  | The purpose of the Course                                    |  |
|  | Discipline Tasks   |  |
|  | <b>Expected Results (Competencies)</b>                       |  |
|  | Sections, topics, questions for independent work of students |  |
|  | Literature   |  |

## Introduction

- The discipline "Normal Physiology" refers to the basic part of the general professional program B1.0.09 of the structure of the program of specialty. For its successful development, knowledge of anatomy, neuroanatomy, histology, embryology, cytology, embryonic development of body tissues, biochemistry is required. "Normal physiology" forms the knowledge base for the subsequent study of pathophysiology, clinical pathophysiology, propaedeutics of internal diseases, the basics of functional and laboratory diagnostics, pathological anatomy, clinical pathological anatomy, pathophysiology of extreme conditions, anesthesiology, intensive care resuscitation, forensic medicine, surgical gastroenterology and endoscopy and for state final certification.

- **The purpose of the Course**

- to form students' systematic knowledge about holistic living organism and its parts, the basic laws of functioning and mechanisms of their regulation of the interaction between each other and with environmental factors, on the physiological basis of clinical and physiological methods of research used in functional diagnosis and the study integrative human activity.

### Objectives:

- the formation of students ' systematic approach to understanding the physiological mechanisms underlying interaction with environmental factors and implementation of adaptive strategies of the human body, the implementation of the normal functions of the human body from the standpoint of the theory of functional systems;
- the study of the methods and principles of the research assessment of the state regulatory and homeostatic systems of the organism in the experiment, taking into account their applicability in clinical practice;
- teaching students methods of evaluation of human functional state, state regulators and homeostatic in different types of purposeful activity;
- formation bases of clinical thinking based on the analysis of the nature and structure interorganic and intersystem relations from the position of integrated physiology for future practical activities of the doctor.

### Expected Results (Competencies)

|                                      |   |
|--------------------------------------|---|
| Code and name implemented competence | The list of planned learning outcomes in the discipline (module), correlated with indicators of achievement of competences  |
| GPC-5                                | <b>Know:</b><br>structure, topography and development of cells, tissues, organs and systems of the body in interaction with their normal function, anatomical and physiological, age-sex and individual characteristics of the structure and development of a healthy |

and large organism; the structure of the human body in relation to function, the functional systems of the human body, their regulation and self-regulation when exposed to the external environment is normal; physicochemical essence of the processes occurring in a living organism at the molecular, cellular, tissue and organ levels; basic patterns of development and vital activity of the organism based on the structural organization of cells, tissues and organs; histo-functional features of tissue elements, methods of their study.

**be able to:**

- use educational, scientific, popular science literature, the Internet for professional activities,
- use physical, chemical and biological equipment; work with magnifying equipment (microscopes, optical and simple loupes); to give a histophysiological assessment of the state of various cellular, tissue and organ structures; interpret the results of the most common methods of functional diagnostics used to identify pathologies of the blood, heart and blood vessels, lungs, kidneys, liver and other organs and systems; evaluate the results of electrocardiography; spirometry; thermometry; hematological indicators; to distinguish in blood serum the normal values of the levels of metabolites (glucose, urea, bilirubin, uric acid, lactic and pyruvic acids, etc.), to register an ECG in experimental animals and humans, to calculate and analyze the leukocyte formula; determine and evaluate the results of electrocardiography; spirometry; thermometry; hematological parameters.

own: methods of assessing the physiological state of the patient; methods of physical examination of the patient.

Independent work is made up of preparing for classes on questions for each lesson and preparation for intermediate control on questions for offset and examination. The following educational technologies are used in the organization of independent work of classes: Auditorium independent work on the discipline is performed on practical exercises under the direct guidance of the teacher and on his instructions. The workshop on normal physiology contains various experimental tasks in accordance with all the main sections of the theoretical course and is independently carried out in the laboratory of the Department of Physiology, equipped with laboratory equipment. As part of the course, students solve virtual problems - this is a simulator for independent work. Outside classroom independent work is performed by the student on the instructions of the teacher, but without his direct participation. The main types of independent work of students without the participation of teachers are: the formation and assimilation of the content of lecture notes on the basis of textbooks recommended by the lecturer, including information educational resources (electronic textbooks, electronic libraries, etc.); preparation for practical work, their design.

**Sections, topics, questions for independent work of students**

| Name of sections and topics | Type of independent work (study of educational material, problem solving, abstract, report, test, | Volume in hours | Form of control (verification of problem solving, essays, etc.) |
|-----------------------------|---|-----------------|---|
|                             |   |                 |   |

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|   | preparation for the test, exam, etc.)   |   |   |
| <b>Section 1 Principles of functioning of organs and systems</b>  |   |   |   |
| <p>Theme 1. Introduction. General physiology and biophysics of excitable tissues.</p> <p>Periods of development of the human body. Age peculiarities of the formation and regulation of physiological functions</p> <p>1. Cell. Its functions.</p> <p>2. Body tissues (epithelial, connective, muscular and nervous), the main features of their functions.</p> <p>3. Features of low-excitability connective tissue (connective, bone, cartilage).</p> | <p>Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.</p> | 1 | <p>Interview, tests, problem solving check.</p> |
| <p>Theme 2. Bioelectric phenomena in living systems.</p> <p>1. Biopotentials of glandulocytes. The secretory cycle.</p> <p>Topic 2. Physiology of nerve fibers and the nerves conductors. Physiology of muscles. Features of the physiology of nerves and synapses in children.</p> <p>1. Electroneurography.</p> <p>2. Physiology of nerve</p>   | <p>Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.</p> | 1 | <p>Interview, tests, problem solving check.</p> |

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| <p>fibers and nerves.</p> <p>3. The parabiosis (N.E. Vvedensky).</p> <p>4. Electromyography.</p>  |   |   |   |
| <p>Theme 3. General physiology of the CNS. Structure and properties of synapses.</p> <p>1. The blood-brain barrier.</p> <p>2. The glia, its function. Methods of research of functions of the central nervous system.</p> <p>3. The physiological meaning of the doctrine of regulation functions for general medicine and clinical disciplines, to form concepts about health and healthy lifestyle.</p> | <p>Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.</p> | 1 | <p>Interview, tests, problem solving check.</p> |
| <p>Theme 4. Inhibition of the nerve centers. Coordination of the reflex activity.</p> <p>1. Features of processes of excitation and inhibition in children</p> <p>2. The iconic function of the brain: gnosis, praxis.</p>  | <p>Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.</p> | 1 | <p>Interview, tests, problem solving check.</p> |
| <p>Theme 5. Physiology of the spinal cord, brainstem and cerebellum.</p> <p>1. The brain stem.</p>  | <p>Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.</p> | 1 | <p>Interview, tests, problem solving check.</p> |
| <p>Theme 6. Physiology</p>  | <p>Elaboration of</p>   | 1 | <p>Interview, tests,</p>                        |

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| <p>of the reticular formation</p> <p>1. Features of neural organization.</p>  | <p>educational material, preparation for the delivery of the colloquium, test and examination.</p>                |   | <p>problem solving check.</p>                   |
| <p>Theme 7. Physiology of the diencephalon, limbic system and basal nuclei. Physiology of the autonomic nervous system. Features of physiology of the Central nervous system of the developing organism. Features of the autonomic nervous system in children</p> <p>1. Physiology of limbic system and basal nuclei.</p> <p>2. The thalamus is a collector of afferent pathways.</p> | <p>Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.</p> | 1 | <p>Interview, tests, problem solving check.</p> |
| <p>Theme 8. Methods of evaluating cardiac activity.</p> <p>1. Ballisto-, echo-, vectorgraphy</p>  | <p>Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.</p> | 1 | <p>Interview, tests, problem solving check.</p> |
| <p>Theme 9. The regulation of heart activity.</p> <p>1. Integration of mechanisms regulating the functioning of the heart.</p>  | <p>Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.</p> | 1 | <p>Interview, tests, problem solving check.</p> |
| <p>Theme 10. The basic laws of hemodynamics</p> <p>1. Regional circulation.</p> <p>2. Methodology of the</p>  | <p>Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.</p> | 1 | <p>Interview, tests, problem solving check.</p> |



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| <p>study of organ blood flow (occlusive, plethysmography, ultrasound, and electromagnetic flowmetry).</p> <p>3. Methods of research of microcirculation.</p> <p>4. Functional features of the pulmonary circulation, coronary blood flow.</p> <p>5. Factors of a healthy lifestyle that prevent the disturbance of the blood circulation system.</p> <p>6. Age features of the circulatory system.</p> <p>7. Change of organ blood flow during muscular exercise, food intake, pregnancy, hypoxia, stress and other conditions.</p> |   |          |   |
| <p>Theme 11. The lymphatic system, its structure and functions. Features of blood circulation in the fetus and in children.</p> <p>1. Chylopoesis and mechanisms of its regulation. The factors supplying the flow of lymph and the mechanisms of its regulation.</p>   | <p>Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.</p> | <p>1</p> | <p>Interview, tests, problem solving check.</p> |
| <p>Theme 12. Physiology of breathing. External respiration. The</p>   | <p>Elaboration of educational material, preparation for the delivery of the</p>                                   | <p>1</p> | <p>Interview, tests, problem solving check.</p> |

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| <p>mechanism of inhalation and exhalation. Transport of gases by blood.</p> <p>1. Transport of gases by blood.</p>  | <p>colloquium, test and examination.</p>  |   |   |
| <p>Theme 13. Digestion in the intestine. Features of the digestive system in children.</p> <p>1. The importance of microorganisms and gas in the intestines.</p>  | <p>Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.</p> | 1 | <p>Interview, tests, problem solving check.</p> |
| <p>Theme 14.1. Thermoregulation.</p> <p>1. Peculiarities of thermoregulation in children.</p> <p>2. Temperature-regulation.</p> <p>3. System mechanisms of thermoregulation and heat transfer.</p> <p>4. Mechanisms of hardening of the body.</p> | <p>Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.</p> | 1 | <p>Interview, tests, problem solving check.</p> |
| <p>Theme 14.2. Metabolism</p>   | <p>Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.</p> | 1 | <p>Interview, tests, problem solving check.</p> |
| <p>Theme 15. Physiology of the excretion. Features of the excretory system in the fetus and children.</p> <p>1. Adaptive changes of renal function in</p>   | <p>Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.</p> | 1 | <p>Interview, tests, problem solving check.</p> |

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| <p>different environmental conditions.</p> <p>2. Skin as an excretory organ. The function of sebaceous and sweat glands, regulation of their activities. Non-excretory function of the skin.</p>   |   |          |   |
| <p>Theme 16. Physiology of the endocrine glands.</p> <p>1. Epiphysis. Thymus.</p>  | <p>Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.</p> | <p>1</p> | <p>Interview, tests, problem solving check.</p> |
| <p>Theme 17. Blood physiology.</p> <p>1. Lymph, its composition, quantity, functions, physiological significance.</p> <p>2. Extravascular fluid of the body (interstitial, cerebrospinal, synovial, pleural, peritoneal, liquid medium of the eyeball, slime) and their role in supplying the vital activity of body cells.</p> <p>3. The factors that maintain the integrity of the body. Barriers external and internal environment of the body. Immunity and its types.</p> <p>Theme 17.1. The organism and its protective systems.</p> | <p>Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.</p> | <p>1</p> | <p>Interview, tests, problem solving check.</p> |

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| 1. Protective reflexes.  |  |   |  |
| Theme 18. Physiology of analyzers.<br><br>1.Acupressure points and the principle of reflexology.   | Elaboration of educational material, preparation for the delivery of the colloquium, test and examination. | 1 | Interview, tests, problem solving check. |
| <b>Section 2. Functional systems of human organism, their regulation and self-regulation when exposed to the external environment</b>  |  |   |  |
| Theme 19. The doctrine about functional systems.<br><br>1.System organization of functions.  | Elaboration of educational material, preparation for the delivery of the colloquium, test and examination. | 1 | Interview, tests                         |
| Theme 20. Functional system providing optimal level of metabolism of gases.  | Elaboration of educational material, preparation for the delivery of the colloquium, test and examination. | 1 | Interview, tests, problem solving check. |
| Theme 21. Functional digestive system and place it in the digestive process.   | Elaboration of educational material, preparation for the delivery of the colloquium, test and examination. | 1 | Interview, tests                         |
| Theme 22.1. The organism's adaptation to different conditions of existence.<br><br>1. Higher nervous activity in children. Antenatal and neonatal periods<br><br>2. Biorythmology (chronobiology). The idea of the discreteness of various processes in the body. Cyclical | Elaboration of educational material, preparation for the delivery of the colloquium, test and examination. | 2 | Interview, tests                         |

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| <p>processes.</p> <p>3. Physiology of adaptation. Individual adaptation. Types, phases, and criteria of adaptation.</p> <p>Theme 22.2. Purposeful behavior.</p> <p>1. Purposeful behavior as a form of behavior leading to achieving the body adaptive result.</p> <p>2. Physiological basis of labour activity.</p> <p>Theme 22.3. The problem of fatigue of the entire organism.</p> <p>1. Leisure (I. M. Sechenov) and its mechanisms.</p> <p>2. Features of physical and mental work.</p> <p>3. The optimum conditions for work and rest as the basis for a long period of high efficiency of the organism.</p> |   |          |                  |
| <p>Theme 23. The phenomenon of inhibition of HNA.</p> <p>1. Types and mechanisms of inhibition of HNA.</p> <p>2. The physiology of sleep.</p> <p>3. The physiological basis of hypnotic conditions.</p>   | <p>Elaboration of educational material, preparation for the delivery of the colloquium, test and examination.</p> | <p>2</p> | <p>Interview</p> |
| <p>Theme 24. The types of</p>   | <p>Elaboration of</p>   | <p>2</p> | <p>Interview</p> |

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| HNA. The doctrine of 1 and 2 signal systems.<br>Memory. Thinking.<br>Consciousness.<br>Language.   | educational material, preparation for the delivery of the colloquium, test and examination.                |   |           |
| Theme 25.<br>Reproduction.<br><br>1. Reproduction stages.<br><br>2. Anatomical and physiological basis of reproduction.<br><br>3. The formation and mechanisms of sexual motivation.<br><br>4. Phase of the sexual cycle in men. Specificity of phases of the sexual cycle in women. | Elaboration of educational material, preparation for the delivery of the colloquium, test and examination. | 2 | Interview |
| Theme 26. Physiology of pain and pain relief.<br><br>1. Pain as a sensation and condition.<br><br>2. Nociception. Antinociception.<br><br>3. Physiological mechanisms of pain and analgesia.   | Elaboration of educational material, preparation for the delivery of the colloquium, test and examination. | 4 | Interview |
| Theme 27. Practical skills   | Elaboration of educational material, preparation for the delivery of the colloquium, test and examination. | 2 | Interview |
| Form of knowledge control on the independent study of the subject: a colloquium, credit and exam.  |  |   |           |

Form of knowledge control on the independent study of the subject: a colloquium, credit and exam.

Literature

**principal literature**

1. Gening T.P., Abakumova T.V., Gening S.O. Physiology of visceral systems: Education guidance for students of medical faculty /. – Ulyanovsk: Ulsu, 2019. – 96 p.

2. Gening T.P., Abakumova T.V., Mikhailova, Kadysheva E.N. Normal physiology. Part II.

Physiology of Cardio-vascular system, Breath, Digestion, Excretion, Endocrine glands,

Metabolism and Energy, Blood. Second Edition Ulyanovsk State University. 2018 135 p.

URL: <ftp://10.2.96.134/Text/Gening2018-2.pdf>

#### **additional literature**

1. Cardiac Biomechanics in Normal Physiology and Disease/Encyclopedia of Cardiovascular Research and Medicine 2018, Pages 411-419

URL: <https://www.sciencedirect.com/science/article/pii/B9780128096574110592>

2. Anatomy & Physiology: Current Research

URL: <https://www.omicsonline.org/anatomy-physiology.php>

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