

**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 **Histology**
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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Methodological Guidelines
for performing laboratory work in the Discipline of **Histology**
for Students majoring (Specialty) in 31.05.01 General Medicine

Aim and Objectives of Mastering the Discipline (Module)

- Aim of mastering the discipline is to form students' ideas about the patterns of development and vital activity of the body based on the structural organization of cells, tissues and organs; histofunctional features of tissue elements, methods of their research....
- Objectives of mastering the discipline
 - study of general and specific structural and functional properties of cells of all body tissues and patterns of their embryonic and postembryonic development;
 - study of histofunctional characteristics of the main body systems, patterns of their embryonic development, as well as functional, age-related, and protective-adaptive changes in organs and their structural elements;
 - study of the basic histological international Latin terminology;
 - formation of the ability of microscopy of histological preparations using a light microscope;
 - formation of the ability to identify organs, their tissues, cells and non-cellular structures at the microscopic level;
 - formation of an idea about the methods of analyzing the results of clinical laboratory studies and their interpretation;
 - formation of skills of independent analytical, scientific and research work;
 - formation of skills in working with scientific literature;
 - formation of skills in the organization of occupational health and safety measures;
 - formation of communication skills and interaction with society and the team.

As a result of studying the discipline, the student should know:

- the basic patterns of development and vital activity of the body based on the structural organization of cells, tissues and organs;
- Histofunctional features of tissue elements;
- Cytological and histological research methods.
- basic patterns of reproduction and differentiation of germ cells of the human body;
- features of private tissue systems within the framework of private histology

Must be able to:

- analyze microscopic preparations, electron micrographs of biological objects in normal and pathological conditions.
- use the acquired theoretical knowledge and practical skills of microscopation in their professional activities

Must be proficient in:

- methods of working with biological, phase contrast, polarization, and luminescent microscopes.
- skills of working with textbooks, atlases, diagrams to improve knowledge in the field of histology, embryology and teratology;
- skills of microscopy, "reading" histological, histochemical and embryological preparations, their descriptions and comparative analysis.

Introduction Brief historical information about the discipline. The subject and objectives of the discipline. The main methods used in histology.

Methods of microscopy of histological preparations. Methods for the study of fixed cells and tissues. Methods of studying living cells and tissues. Methods for studying the chemical composition and metabolism of cells and tissues. Methods of immunofluorescence analysis. Quantitative methods. Methods of image analysis of cellular and tissue structures.

Tissues as systems. Epithelial tissues. Glands.

Tissues as system. Tissue definition. Classification of tissues and general patterns of their formation. Tissue development. Determination and commitment. The concept of divergent tissue development in phylogeny and ontogenesis, formulated by N.G.Khlopin. The theory of

parallelisms by A.A.Zavarzin. Tissue homeostasis. Fundamentals of cell population kinetics. Genetic, morphological, and functional classification of epithelia. Common signs characteristic of epithelial tissues. Single-layer epithelium, its types, structural features. Multilayer epithelium, its types, structure, functional significance, origin and location in the body. Glandular epithelium, its characteristics, origin and location in the body. Phases of the secretory cycle and their characteristics. Classification of glands

Connective tissues.

General principles of organization and classification of connective tissues. Characteristics of the connective tissue proper, its classification. Fibrous connective tissues, development, structure, functions and location. Loose fibrous connective tissue. Morphological and functional characteristics of cells, fibers, and basic matter. Dense fibrous connective tissue, its development, structure, functions and location. Fibrous membranes

Connective tissues with special properties.

General morphofunctional characteristics connective tissues with special properties. Morphology, functional significance and location of adipose tissue

Skeletal tissue.

Cartilage tissue, development, general characteristics, cellular composition, intercellular substance. Types of cartilage tissue, structural features, regeneration. Age-related changes. Bone tissue. Bone development directly from mesenchyme (direct osteohystogenesis) and in place of cartilage (indirect osteohystogenesis). Bone cells (osteoblasts, osteocytes, osteoclasts). The structure and chemical composition of the intercellular substance. The structure of the bone as an organ. Coarse-fibrous and lamellar bone tissue. The structure of the periosteum. Bone restructuring during the development and growth of the body. Osteon – structural a unit of compact substance of a tubular bone. Factors affecting bone growth. Regeneration of bone tissue

Blood and lymph. Hemocytopoiesis. Organs of hematopoiesis

The concept of the blood system. Blood. General information about its composition and functions. Blood plasma, its composition and significance. I.I.Mechnikov's research on phagocytosis. Shaped elements, their number, shape, size, structure, meaning. The concept of hemogram and leukocyte formula, their age-related changes. Lymph, its composition and significance. Embryonic hemocytopoiesis (the development of blood as tissue). Postembryonic hemocytopoiesis (the process of physiological regeneration of blood). Regulation of hemocytopoiesis.

Muscle tissue.

General characteristics of muscle tissue: sources of development, classification. Smooth muscle tissue, location, histogenesis, structure, features of functioning and regeneration. Skeletal muscle tissue: location, histogenesis, microscopic structure of muscle fiber. The structure of myofibrils. Features of development, structure and functions of cardiac muscle tissue. The structure of contractile and conductive cardiomyocytes. Regeneration of cardiac muscle tissue. Histophysiology of muscle contraction

Nervous tissue. Neurons. Neuroglia.

Embryonic sources of neuronal and gliocyte development. Morphological and functional classification of neurons. Microscopic, ultramicroscopic, and histochemical characteristics of a nerve cell. Neurosecretory cells. The difference between neurons and neurosecretory cells. The structure and functions of neuroglia. Ependyma, astroglia, oligodendroglia, microglia. The relationship of neurons and neuroglia. Regeneration of nervous tissue. Processes of nerve cells: axons and dendrites. The structure of fleshy and meatless nerve fibers. Formation and structure of myelin sheaths Classification of synapses. The concept of neurotransmitters and their nature.

Synapses, their microscopic and ultramicroscopic structure, histochemical characteristics, and significance. Myoneural synapses as an example of efferent nerve endings. Afferent nerve endings. Structural features of the three-neural reflex arc.

The nervous system. The spinal cord. The brain stem.

Development. Nerve trunks. Sensitive nerve nodes. The spinal cord. The medulla oblongata. The middle brain. The intermediate brain

The nervous system. The cerebellum. A big brain.

Membranes of the spinal cord and brain. The cerebellum. A big brain. The autonomic nervous system

The sensory organ. The organ of vision. The organ of hearing. Organs of smell and taste

The organ of vision. The development of the eye. Fibrous membrane. The dioptric apparatus of the eye. The accommodative apparatus of the eye. The vascular membrane of the eye. The iris. The retina of the eye. Auxiliary apparatus of the eye. The organ of smell The organ of hearing and balance. The outer ear. The middle ear. The inner ear. The path of the sound wave to the hair cells and the sound pulse to the cortical end of the auditory analyzer. Sensitive spots of the uterus and round sac. The mechanism of perception of linear acceleration and gravity. The pathways of nerve impulses from the vestibular apparatus. The organ of taste

Vessels. Veins. Lymphatic vessels. Heart.

Classification of vessels. Elastic, mixed, and muscular type arteries. Microcirculatory system. Classification of capillaries. Veins of non-muscular and muscular type. Vessels of vessels. Lymphatic vessels. Age-related vascular changes. Heart. Development. The endocardium. Valve apparatus. The myocardium. The conduction system of the heart. Epicardium. Innervation of the heart. Age-related heart changes

The endocrine system.

The nature of hormones. The mechanism of action of hormones on target cells. Classification of the endocrine system. Hypothalamus. Regulation of peripheral gland function by the hypothalamus. The pituitary gland. Classification of adenocytes. The hypothalamic-pituitary portal system and its role in regulating the functions of the adenohypophysis. The epiphysis Thyroid gland. The parathyroid glands. The adrenal glands. Diffuse endocrine system

The digestive system. Digestive glands.

The general outline of the digestive tube structure. The oral cavity. Language. Large salivary glands. Teeth. The esophagus. Stomach. The small intestine. The large intestine. A vermiform appendage. Liver. The general plan of the building. The circulatory system of the liver. Biliary tract and gallbladder. Age-related changes. The pancreas. The exocrine part. The endocrine part

Respiratory system.

Development. The nasal cavity. A sip. The larynx. The trachea. The mucous membrane. The submucosal base. Fibrous-cartilaginous membrane. The adventitious shell. Blood supply and innervation of the trachea. Lungs. Bronchi of large and medium caliber. Terminal bronchioles. Respiratory department of lungs. The alveoli. Blood supply and innervation of the lungs. Age-related changes. Kidney development. The structure of the kidney.

Urinary system.

The nephron. Classification of nephrons. Blood supply to the kidney. Juxtamedullary blood supply system. Histophysiology of nephrons or the process urinary formation. The endocrine system of the kidneys. Innervation and age-related kidney changes. Urinary tract. The bladder

The male reproductive system.

Development. The testicle. Spermatogenesis. Endocrine function of the testes. Innervation and age-related changes of the testicles. Vas deferens. Accessory glands of the male reproductive system. The penis.

The female reproductive system.

The structure of the ovaries. Ovogenesis. Differences between ovogenesis and spermatogenesis. Ovulation. The yellow body. Atresia. Endocrine function of the ovaries. The fallopian tubes. Uterus. Vagina. The sexual cycle. Mammary glands

Organs of hematopoiesis and immune defense.

Red bone marrow. Blood supply, regeneration, age-related changes in red bone marrow. Myelopoiesis. Classes of hematopoietic cells. The thymus. Development. The cortical substance. Brain matter. Age-related and temporal involution of the thymus. Lymph nodes. Development. The cortical area. The paracortical zone. Brain matter. Sinuses of the lymph nodes. The spleen. Development. White pulp. Red pulp. Palatine tonsils. Lymph nodes of the gastrointestinal tract

Preparations for studying and sketching

1. Mesothelium.
2. Ciliated epithelium (of the intestine of the toothless).
3. Single-layer high/low epithelium of the kidney.
4. Multilayer flat non-corneal epithelium (cow's cornea).
5. Multi-layered flat keratinizing epithelium of the finger skin.
6. Transitional epithelium of the bladder.
7. Glandular epithelium (the green gland of cancer)
8. Frog blood.
9. Human blood
10. A smear of red bone marrow.
11. The lymph node.
12. The spleen
13. Smooth muscle tissue.
14. Cross-striped fabric.
15. Cardiac muscle tissue
16. Loose fibrous connective tissue.
17. A tendon in a longitudinal section.
18. A cross-sectional tendon.
19. Elastic ligament.
20. Adipose tissue.
21. Reticular tissue of the lymph node
22. Hyaline cartilage.
23. Fibrous cartilage.
24. Elastic cartilage.
25. Transverse bone incision (osteon).
26. The knee joint of a rat.
27. Coarse fibrous bone tissue.
28. Nerve cells of the spinal node.
29. Neurofibrils.
30. Tigroid.
31. Astrocytes
32. Limp nerve fibers.
33. Fleshy nerve fibers.
34. Transverse incision of the nerve.

35. The end plate of the motor nerve
36. Meissner's sensitive little body.
37. The lamellar body
38. Spinal node.
39. The spinal cord.
40. The medulla oblongata.
41. Black substance.
42. The cerebral cortex.
43. The cerebellum.
44. Sympathetic ganglion.
45. The cornea.
46. The eyelid.
47. The angle and bottom of the eye.
48. The eye of the embryo
49. The inner ear (cortical organ).
50. Taste buds of the tongue.
51. The neurovascular bundle.
52. Elastic type artery.
53. An artery of a muscular type.
54. Superior vena cava.
55. Inferior vena cava.
56. A vein with a valve.
57. Arterioles, venules, and capillaries
58. The myocardium of a newborn
59. Adult myocardium
60. The nuclei of the anterior hypothalamus.
61. Human pituitary gland
62. Active thyroid gland.
63. Inactive thyroid gland.
64. The adrenal gland
65. A smear of red bone marrow.
66. Section of red bone marrow
67. Intact thymus of the child.
68. Age-related atrophy of the thymus.
69. The baby's spleen.
70. The spleen of an adult.
71. The appendix of a newborn.
72. Palatine tonsil.
73. Human lymph node.
74. Hematopoiesis in the liver.
75. Fabric duck bag
76. Teeth.
77. Language.
78. Submandibular and parotid salivary glands.
79. Cardiac department of the stomach.
80. The pyloric section of the stomach.
81. The body of the stomach.
82. Duodenum.
83. The large intestine.
84. Appendix.
85. Liver.
86. The mucous membrane of the gallbladder.

87. The pancreas
88. Skin with hair.
89. Finger skin
90. Bronchial wall.
91. Easy
92. The kidney of a premature baby.
93. A newborn's kidney.
94. An adult's kidney.
95. The bladder
96. The testicle of a newborn.
97. Spermatogenesis in an adult male.
98. Depressed spermatogenesis in an alcoholic.
99. The testis of the appendage
100. The ovary of a newborn
101. The ovary of a woman.
102. The uterus of a newborn
103. The endometrium is in the proliferation phase.
104. Endometrium in the secretion phase.
105. Fallopian tube.
106. Active mammary gland
107. The mammary gland is inactive
108. The embryonic placenta.
109. Mature placenta

Educational, Methodological, and Informational Support for the Discipline

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

List of Main Literature:

Ross, Michael H. Histology: a text and atlas: with correlated cell and molecular biology/Michael H. Ross, Wojciech Pawlina.—6th ed. p. ; cm Includes bibliographical references and index. ISBN 978-0-7817-7200-6 (alk. paper) 1. Histology. 2. Histology—Atlases. I. Pawlina, Wojciech. II. Title. [DNLM: 1. Histology—Atlases. QS 517 R825h 2011] QM551.R67 2011611'.018—dc22

List of Additional Literature:

Barsukov, N. P. Cytology, histology, embryology : a textbook / N. P. Barsukov. – 4th ed., ster. – Saint Petersburg : Lan, 2020. – 248 p. – ISBN 978-5-8114-5352-8. – Text : electronic // Lan : electronic library system. – URL: <https://e.lanbook.com/book/139250>

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

1. <http://rudocor.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 pharmacological reference
5. <https://dic.academic.ru/> - Dictionaries and encyclopedias
6. <https://www.rmj.ru/> - Russian Medical Journal