

COURSE SYLLABUS
HISTOLOGY, CYTOLOGY, AND EMBRYOLOGY

(course name)

Field of Study: **222 «Medicine»**
Educational and Professional Programme in **Medicine**
Course Code: **MC 08**
Higher Education Level: **Second (Master's) Degree**
Level
Study Mode: **Full-time**
Semester: **2-nd (spring)**
Course Type: **Mandatory**
Academic Year: **2024-2025**

Credit Load: **6.0 ECTS credits (180 hours)**
Teaching Activities: **Lectures, Practical Classes**
Final Assessment: **Current Academic Activity Evaluation**
Prerequisites: **course of Biology of general education in high school**

Department/Unit: **Department of Histology, Cytology, and Embryology**, 4 Nauky Ave., Academic and Laboratory Building, 3-d Floor.

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Course Page at the KhNMU Distance Learning System (Moodle):

<https://distance.kntmu.edu.ua/course/view.php?id=6236>

COURSE OVERVIEW

“Histology, Cytology and Embryology” course presents the fundamentals of cytology and embryology and offers a broad overview of various types of tissues, as well as the microscopic anatomy of different human organs. The human body consists of an enormous variety of cell types which, in turn, are organized into tissues and organs that perform complex vital functions. Histology is a science that studies the cellular architecture of tissues and provides a deeper comprehension of body function. This course explains the structure of tissues and organs in close correlation with their functions.

COURSE AIM. The course is designed to develop students’ understanding of the structural basis of human vital activity and the possibilities for their targeted regulation.

LEARNING OUTCOMES:

- To have thorough knowledge of the structure of professional activity. Be able to carry out professional activities that require updating and integration of knowledge. Be responsible for professional development, the ability for further professional training with a high level of autonomy.
- Understanding and knowledge of fundamental and clinical biomedical sciences, at a level sufficient to solve professional tasks in the field of health care.
- Specialized conceptual knowledge, which includes scientific achievements in the field of health care and is the basis for conducting research, critical thinking in the field of medicine and related interdisciplinary problems.
- To have ability to search for the necessary information in the professional literature and databases of other sources, to analyze, evaluate, and apply this information
- To apply modern digital technologies, specialized software, and statistical methods of data analysis to solve complex health care problems.
- To clearly and unambiguously convey one’s own knowledge, conclusions and arguments on health care problems and related issues to specialists and non-specialists, in particular to people who are studying.

COURSE CONTENT

Lecture Topics (20 hours):

1. Introduction. Cytology.
2. Essentials of Embryology.
3. Epithelial Tissues.
4. Tissues of the Internal Environment. Blood. Lymph. Hematopoiesis.
5. Connective Tissues.
6. Skeletal Tissues. Bone and Cartilage Tissues.
7. Muscle Tissues.
8. Nervous Tissue.
9. Nervous System.
10. Sensory System. Skin and Its Derivatives.

Practical Class Topics (60 hours):

1. **Organization of the educational process at the Department of Histology, Cytology and Embryology.** Subject matter and objectives of Histology. Research methods in Histology. Main contemporary trends in the development of Histology. Light and electron microscopy. Histological specimen. Section as the primary type of histological specimen. Staining techniques. Histological images. Identification of cells and their components in histological images. General structural features of human cells. Biological membrane. Organelles and their classification. Nucleus and its structural components. Cell cycle and life cycle of cells. Mitosis and its phases. Types of cell death.
2. **Embryology (1).** Progenesis. Structure of the spermatozoon and oocyte. Early stages of embryogenesis: zygote, cleavage of the human zygote, blastocyst.
3. **Embryology (2).** Late stages of embryogenesis: gastrulation; differentiation of germ layers – neurulation, somitogenesis, splanchnotome, mesenchyme. Germ layers and their derivatives as precursors of histogenesis.
4. **Epithelial Tissues.** Definition of epithelium as a tissue. Types of epithelia. Covering epithelia as surface and barrier tissues: general structural features and functions. Structural features of epithelial cells: intercellular junctions, apical and basal surface specializations. Morphological classification of epithelia. Identification and classification of epithelia in histological images. Film-type tissue specimen as the second type of histological preparation. Glandular epithelium. Secretion: exocrine and endocrine. Secretory cells – structural features. Exocrine and endocrine glands.
5. **Blood. Lymph. Hematopoiesis.** Composition: plasma and formed elements. Hematocrit. Hemogram. Erythrocytes. Platelets. Leukocytes as cells of blood and connective tissue. Leukocyte formula. Blood smear as a type of histological specimen. Identification of formed elements in microphotographs. Postnatal hemopoiesis.
6. **Connective Tissues.** General characteristics and classification. Fibrous connective tissues: dense irregular and dense regular connective tissue. Structure and function of loose connective tissue and its role in metabolic reactions. Cellular components of connective tissues. Extracellular matrix (fibers and ground substance). Cells responsible for ECM production. Connective tissues with special properties. Identification in histological specimens. Structures and organs formed by connective tissue: ligaments, tendons. Adipose tissue.
7. **Skeletal Tissues. Cartilage.** Types of cartilage. Hyaline cartilage. Structural features of cartilage as a tissue rich in extracellular matrix (using hyaline cartilage as an example). Cellular composition. Chondrogenesis and growth of cartilage. Hyaline cartilage (costal cartilage as example). Connective tissue components of cartilage. Fibrocartilage (comparison with related tissues). Elastic cartilage.
8. **Bone Tissue and Bone as an organ.** Bone as a specialized connective tissue. Bone as an organ: types of bones; compact and spongy substance. Types of bone tissue. Woven bone. Features of extracellular matrix. Cellular composition (using woven bone as an example). Osteogenesis. Intramembranous ossification. Lamellar bone: structure of compact bone of the diaphysis of a long

bone (osteons and lamellae). Organization of spongy bone (trabeculae). Remodeling from woven to lamellar bone. Formation of osteons and interstitial lamellae. Bone surface and cavities. Periosteum and endosteum. Blood supply. Indirect (endochondral) ossification of long bones. Bone growth in length (epiphyseal plate) and width. Other types of bone connections. Articular cartilage and joint structure.

9. **Muscle Tissues.** Types of muscle tissues. Skeletal muscle tissue. Structural features of contractile cells. Myofibrils. Mechanism of muscle contraction (sliding filament theory). Skeletal muscle as an organ. Connective tissue components of muscle. Muscle attachment. Cardiac muscle tissue. Smooth muscle tissue.

10. **Nervous Tissue.** Components: neurons and neuroglia. Neuron: structural components; life cycle features. Morphological types of neurons. Nerve impulse. Functional specialization. Simple and complex reflex arcs. Synapses. Effector nerve endings. Motor units. Nerve fibers. Glia of CNS and PNS. Oligodendrocytes and Schwann cells. Sensory nerve endings.

11. **Final Control 1** “Cytology. Embryology. General Histology.”

12. **Nervous System.** CNS structure: gray and white matter. Spinal cord. Brain: cerebrum, cerebellum (cortex, neuron types, connections), brainstem (nuclei). Nervous regulation. Somatic and autonomic divisions. Hypothalamus. Reflex arcs: somatic and autonomic (localization of neurons). Autonomic ganglia, including intramural ganglia. PNS. Spinal ganglia and satellite glial cells. Structure of a nerve; types of nerve fibers. Connective tissue components of nerves.

13. **Primary Sensory Organs (1).** Organ of vision. Organ of olfaction.

14. **Secondary Sensory Organs (2).** Organs of taste, hearing and balance. Sensory epithelium.

15. **Skin and Its Derivatives.** Types of skin. Structure and developmental sources. Exteroceptors. Nails, hair. Sebaceous and sweat glands.

Topics for Laboratory classes:

Laboratory classes are not provided for the curriculum.

Topics for Student's Independent Work (100 hours):

1. Methods of histological investigation. Histological tissue processing and slide preparation techniques.
2. Cellular responses to external stimuli. Structure of plasma membrane receptors.
3. Cytoplasm. structural basis of cytoprotection (peroxisomes, proteasomes, antioxidant enzyme systems).
4. Principles of tissue development in phylogeny and ontogeny.
5. Epithelium as a major component of histophysiological (blood–tissue) barriers.
6. Epithelial stem cells.
7. Leukocytes. mechanisms of adhesion, migration, and microbial killing.
8. Stages of embryonic hematopoiesis. differentiation of blood islands.
9. Repair of loose (areolar) connective tissue. Cell-matrix interactions in loose connective tissue. Regulation of connective tissue matrix volume and composition.
10. Cooperative interactions between blood and connective tissue cells in inflammation and immunity.
11. Structural and functional features of articular cartilage.
12. Bone remodeling and bone tissue regeneration.
13. Skeletal muscle as an organ. Muscle regeneration.
14. Nerve endings. neuromuscular spindles (muscle spindles).
15. Central and peripheral components of the autonomic nervous system.
16. Embryogenesis of the peripheral part of the visual system. Development of the vomeronasal organ and its significance in humans.
17. Embryogenesis of the peripheral parts of the auditory, vestibular, and gustatory systems.
18. Nails. Growth and development of hair and nails.
19. Development of the cardiovascular system.

20. Development of endocrine glands.
21. Diffuse endocrine system (APUD system / diffuse neuroendocrine system).
22. Transhypophyseal and parahypophyseal regulation.
23. Embryogenesis of hematopoietic organs.

Student's Independent Work (SIW) is aimed at deepening and consolidating the theoretical knowledge acquired during classroom learning and contributes to the development of professional competencies. The results of SIW are subject to being evaluated and included in the final knowledge assessment.

Consultations are held online in tune with the department consultation schedule and require prior registration using teacher's e-mail corporate account.

Teaching Methods: oral assessment (individual and whole-class questioning); written assessment; test-based assessment; creative assignments; individual tasks; project-based learning; self-assessment; presentation on an assigned topic; poster presentation; and others.

ASSESSMENT

Current Learning Activity (CAA). Student performance is assessed in accordance with the Instruction on Assessment of Student Academic Activities at KhNMU (https://knmu.edu.ua/doc_block_type/instrukcziyi-navchalnogo-proczesu/). The mark for a Practical Class or Final Control ranges from 2 to 5 points. Submission of homework assignments late without valid reasons results in a reduction of the mark proportionally to the time delay. Homework assignments are checked by teacher within 24 hours. Marks are put in the electronic journal. Unsatisfactory marks should be reworked in accordance with the KhNMU Regulations on Reworking Bad Marks and Missed Classes (https://knmu.edu.ua/wp-content/uploads/2021/05/pol_por-vidprac-zaniat.pdf).

Individual Assignments. Student's Individual Assignments (hereinafter – SIA) are not a mandatory component of the study. However, they may be completed at the student's choice and assessed in ECTS points (no more than 10), which are added to the total points earned for Current Academic Activity. The list of individual assignments, approved by the annual Department Meeting, includes: 1) presentation of reports at student conferences; 2) taking part at Histology contests, and 3) preparation of scientific reviews with presentations checked for plagiarism. The number of points assigned for their completion could be added to the Total Score as bonus points (no more than 10).

Final Assessment. At the end of the semester a student is attested positive and is allowed to continue study next semester when he/she attended all of the lectures, practical classes and doesn't have any bad/unsatisfactory marks.

Appealing Final Assessment Results. The results of the Final Assessment may be appealed following the procedure established by KhNMU (https://knmu.edu.ua/wp-content/uploads/2021/05/polog_apel_kontrol.pdf).

COURSE POLICIES

Course Recommendations: Students are encouraged to actively participate in all class activities, spend 1–2 hours daily on homework assignments and proper preparation for practical classes. They should ask questions during classes, attend teacher's consultations, submit homework assignments on time, and accomplish all assessment tasks.

Class Attendance: Students are required to attend all lectures and practical sessions. During off-line practical classes a white medical coat must be worn. Students who arrive more than 5 minutes late may not be allowed to take part at the class. Missed classes should be reworked following the KhNMU Regulations on Reworking Bad Marks and Missed Classes (https://knmu.edu.ua/wp-content/uploads/2021/05/pol_por-vidprac-zaniat.pdf).

Academic Honesty: KhNMU upholds a zero-tolerance approach to academic dishonesty. Any violations of academic honesty will be addressed by the university in accordance with the established KhNMU procedures, including the application of appropriate disciplinary actions. (https://knmu.edu.ua/wp-content/uploads/2021/05/polog_ad-1.pdf).

Use of Electronic Devices and AI Tools: Students may use electronic devices and AI tools only after teacher's approval.

Policy for Students with Special Educational Needs: Students with special educational needs should contact their teacher to design an individualized educational plan.

Teacher's Response Time: The teacher will respond to student's inquiries within 24 hours.

Technical Requirements for the Course:

Students are expected to have:

- Access to a computer, laptop, tablet, or smartphone.
- A corporate Google account with a personal photo.
- Skills in using Google Workspace applications (Google Meet, Docs, Sheets, Slides, Forms) and Moodle.

Technical Support: Assistance with technical issues related to the course is available through the designated support channels: ACY (ev.shevtsov@knmu.edu.ua), Google (tehotdelknmu@gmail.com), Moodle (al.korol@knmu.edu.ua)

SUGGESTED READING RESOURCES

1. Junqueira's Basic Histology: Text and Atlas. Anthony L. Mescher. – McGraw-Hill Education, 17th Edition, 2023. – 576 p.
2. Kierszenbaum A.L., Tres L.L. Histology and Cell Biology. – Elsevier, 6th Edition, 2025. – 824 p.
3. Ross M.H., Pawlina W. Histology. A Text and Atlas. – Wolters Kluwer, 9th North American Edition, 2023. – 1104 p.
4. Gartner & Hiatt's Atlas and Text of Histology. – Wolters Kluwer, 8th North American Edition, 2022. – 648 p.
5. Geraldine O'Dowd, Sarah Bell, Sylvia Wright. Wheater's Functional Histology. – Elsevier, 7th Edition, 2023. – 480 p.

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