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**Department of Histology, Cytology and Embryology**



APPROVED

First Pro-rector for scientific  
and pedagogical work  
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\_\_\_\_\_ " \_\_\_\_\_ 2021

**WORK ACADEMIC PROGRAMME**

**COURSE**

**HISTOLOGY**

(Name of discipline)

training specialists second (master's) level of higher education

22 area of expertise "Healthcare"

222 specialty "Medicine"

Discussed and approved  
on methodological meeting of the department  
histology

Protocol № 1  
the " 27 " august 2021

Head of Department  
Assoc. Prof. Ilona Chelpanova



Approved  
profiled methodical commission  
of biomedical sciences

Protocol number 4  
from "31" \_\_ august 2021 .

Chairman of the methodical commission  
\_prof. Lutsyk A.D.

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Professor of Medical Biology Lviv National Medical University named Danylo Galician, head of Vorobets ZD

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## INTRODUCTION

Program of study discipline "Histology, cytology and embryology" composed according to the standard of higher education in Ukraine (hereinafter - the Standard) the second (master's) level of higher education

(Name of higher education)

22 area of expertise "Healthcare"

222 specialty "Medicine".

specialization (s) \_\_\_\_.

(Code name and specialization)

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\_\_\_\_ educational program. (Name of the educational program)

### **Description of discipline (abstract)**

The term "histology" (from the Greek. Histos fabric + logos word science) suggested German scientist Karl Mayer in 1819, so called science of multicellular tissues of animals and humans. However, the volume and value of histology is the subject went beyond literal translation of his name. Histology studies not only the fabric but also the cells from which they are formed, the structure of organs and body systems. According to this distinction following sections subject: cytology (the study of cells); general histology, or actually histology (tissue studies); Special histology (studying the structure of organs and systems). Closely related to the science of histology and development of the embryo - embryology, as the structure of the organism in the study of their emergence and development. Embryology as cytology, histology now separated from and is independent science, but medical training course of higher education are combined in one piece with histology. Thus, the full name of the course - histology, cytology and embryology.

The subject of study of discipline is microscopic and ultramicroscopic structure of cells, tissues and organs of the human body

Interdisciplinary connections: based on the study of medical students of biology, anatomy and integrated with these disciplines; lays the foundation study of Physiology, Biochemistry, Pathology and Pathophysiology, Clinical propaedeutics discipline that involves the integration of teaching with these disciplines and forming of abilities to apply knowledge of histology, cytology and embryology in further education and in professional activities

## 1. The purpose and objectives of discipline

1.1. The goal of teaching "Histology, cytology and embryology" is the study of microscopic structures and ultramicroscopic structure of the human body, its development and changes in the different conditions of life.

1.2. The main objectives of the discipline "Histology, cytology and embryology" are:

- Studying the molecular and structural bases of operation and renewal of cells and their derivatives
- Study the basics adaptation, reactivity and maintain homeostasis
- Identification of adaptation and regenerative capacity of the tissue based on their composition, characteristics and regulation of age-related changes
- Interpretation of laws embryonic development rights, regulation of morphogenesis
- Identify critical periods of embryogenesis, defects and anomalies of human development

1.3 Competencies and learning outcomes, which promotes the formation of discipline (relationship with the normative content of training seekers of higher education, formulated in terms of learning outcomes in Standard).

According to the requirements of the standard provides the discipline of students' competences:

- integrated: Ability to solve common and complex specialized tasks and practical problems in learning, which provides research and / or implementation of innovation and characterized by complexity and uncertainty of the conditions and requirements
- general:**
- The ability to apply knowledge of histology, cytology and embryology in practical situations
- Knowledge and understanding of the subject area of histology, cytology and embryology
- The ability to select the strategy of communication; ability to work in a team; interpersonal interaction skills
- The ability to communicate in their native language both orally and in writing; ability to communicate in a second language
- skills to use information and communication technologies

- The capacity for abstract thinking, analysis and synthesis, capacity to learn and be trained in modern
- The ability to assess and ensure the quality of work;
- certainty and persistence on tasks and responsibilities taken
- special (professional, substantive):
- capacity for evaluation of laboratory results

Details competencies according to the NLC descriptors in the form of "Matrix of competencies."

## **The matrix of competencies**

Number Competence Knowledge Skills Communication Authority and Responsibility

### **Integral competence**

The ability to solve common and complex specialized tasks and practical problems in professional

of health, or in the process of learning that involves a studies and / or implementation of innovation and characterized by complexity and uncertainty conditions and requirements.

### **General competence**

1. Ability to apply knowledge of histology, cytology and embryology in practical situations have specialized conceptual knowledge acquired during the training. To be able to solve complex problems and issues that arise in professional activities. Clear and unequivocal reports of their findings, knowledge and explanations that justify them to specialists and non-specialists. To be responsible for decision making difficult conditions

2. Knowledge and understanding of the subject area of histology, cytology and embryology have profound knowledge of the structure of the profession. To be able to carry out professional work that needs updating and integration of knowledge. The ability to form effective communication strategy in professional activities bear responsibility for professional development, capacity

### **Further professional teaching with high autonomy.**

3 Ability to select the strategy of communication; ability to work in a team; Know the skills of interpersonal interaction tactics and communication strategies, laws and methods of communicative behavior be able to choose methods and communication strategies for effective teamwork Use communication strategies and skills of interpersonal interaction bear responsibility for the selection and tactics way communication

4 The ability to communicate in their native language both orally and in writing; ability to communicate in a second language have a perfect knowledge of the native language and basic knowledge of foreign languages able to apply knowledge of the native language, both oral and written, be able to communicate in a foreign language. Use at professional and business communication and preparation of documents native language. Use a foreign language in professional activities bear responsibility for fluency native language, development professional knowledge.

5 skills to use information and communication technologies have profound knowledge in the field of information and communication technologies used in professional activity able to use information and communication technologies in the professional field that needs updating and integration of knowledge. Use information

and communication technologies in professional activity bear responsibility for the development of professional knowledge and skills.

6 The capacity for abstract thinking, analysis and synthesis, capacity to learn and be trained in modern. Know the methods of analysis, synthesis and further study of contemporary able to analyze information, make informed decisions, be able to acquire modern knowledge Establish appropriate communications to achieve objectives. bear responsibility for timely gain modern knowledge.

7 The ability to assess and ensure the quality of work. Know the methods of evaluation of performance indicators. To be able to provide quality fulfilling work. Establish relationships to ensure quality fulfilling work. bear responsibility for quality performance works.

8 Certainty and persistence on tasks and duties undertaken know the responsibilities and perform the tasks routes able to determine the goals and objectives to be persistent and diligent in the performance of duties establish interpersonal relationships for effective implementation of tasks and responsibilities Responsible for quality implementation assigned tasks

### **Special (professional, substantive) competence**

1 Capacity for evaluation of laboratory results have specialized knowledge about human organs and systems, aware of the standard methods of laboratory tests able to analyze the results of laboratory tests and on their basis to assess information on the diagnosis of the patient proved to appoint and evaluate the results of laboratory tests bear responsibility for decision for evaluating laboratory results

Learning Outcomes: Evaluate information on the diagnosis in terms of health institution, his unit, using knowledge of human, his organs and systems, based on laboratory results

### **2. The information amount of discipline**

In studying the discipline given 345 hours 11,5 ECTS credits.

If the program is structured in modules:

Module 1. Cytology, general Histology and Embryology

Module 2. Special histology and embryology

# Lectures themes.

## First semester.

№	Topic of the lecture
1	Introduction to Histology, Cytology and Embryology. Eukaryotic cell, functions, reproduction, development, adaptation and recovery of multicellular organisms.
2	Early human embryogenesis. Periods of embryogenesis. Characteristics of gametes. Gametogenesis. Fertilization. Cleavage. Implantation. Gastrulation.
3	Introduction to the theory of tissues. Tissue, as a system of histological elements. Cells and their derivatives. Epithelial tissues. Cell therapy as one of the areas of regenerative medicine.
4	Blood and Lymph. Cells (neutrophils, eosinophils, basophils, macrophages), chemical mediators (chemokines, cytokines, bactericidal proteins and complement system) and inflammation processes in the system of nonspecific protection. Hematopoiesis.
5	Connective tissues. General characteristics, classification. Cells of loose connective tissue. Resident cells and wandering cells. Classification of tissues with special properties.
6	Muscular tissues. Properties, classification, structure. Structural bases of growth of muscle fibers. Adaptation of skeletal muscle to the changing of physical activity. Regeneration of skeletal muscular tissue.
7.	Nervous tissue. General characteristics. Sources of development, structure, functional properties and meaning. The concept of neurotransmitters.
8.	Central and peripheral nervous system. General morphofunctional characteristics. Regularities of development. Classification (anatomical and functional).
9.	Sensory systems: types, links, functional meaning. General characteristics of sensory organs. Classification of sensory organs. Structure of the Eye.



## Second semester.

№	Topic of the lecture
1	Cardiovascular System. Structure and Classification of Vessels. Structure of the Heart.
2	Endocrine System. Histophysiological principles of neurohumoral regulation.
3	Digestive system – general characteristics. Oral cavity, Teeth.
4	Pharynx, Esophagus, Stomach. Histophysiology of digestion.
5	Small and Large Intestine. Peculiarities of mucosa structure of different parts of intestine.
6	Glands, associated with Digestive Tract. Salivary glands. Liver and Pancreas.
7	General morphofunctional characteristics of respiratory organs.
8	Kidneys and Urinary tract. Histophysiology of urine formation.
9	Male Reproductive system. General characteristics. Sources and course of development.
10	Female Reproductive system. Functions. Principles of regulation. Ovarian-menstrual cycle: phases, regulation.

Note: duration of every lecture - 2 hours.

In total: 38 hours.

## Practical lessons themes.

№	Topic of the lab lesson
1.	Microscope. Histological techniques.
2.	Cytology. Noncellular structures. General Structure of the Cell. Superficial complex. Cytoplasm. Organelles, Inclusions.
3.	Cytology. Nucleus of the Cell. Cell Reproduction. Cell Aging and Cell Death.
4.	Early Human Embryogenesis. Periods of Embryogenesis. Characteristics of Gametes. Gametogenesis. Fertilization.
5.	Human embryonic development. Cleavage. Implantation. Gastrulation*
6.	<b>Summary lesson №1. Cytology and Embryology (P. I.)</b>
7.	<i>Summary lesson №1. Cytology and Embryology (P. II).*</i>
8	Conception about Tissues. Classification of Tissues. Epithelial tissues. Morphology and classification of glands.
9.	Blood and Lymph. Hematopoiesis. White Blood Cells Count.
10.	Connective tissues. Classification. Cells of loose connective tissue. Noncellular structures.
11	<b>Summary lesson №2. Epithelium, blood and connective tissues (P. I.)</b>
12	<i>Summary lesson №2. Epithelium, blood and connective tissues (P. II).*</i>
	Skeletal connective tissues. Cartilage.
13	<i>Skeletal connective tissues. Bone.*</i>
14	Muscle tissues.

15	Nervous tissue.
16	<b>Summary lesson № 3. Musculoskeletal and specialized tissues. (P. I).</b>
17	<i>Summary lesson № 3. Musculoskeletal and specialized tissues. (P.II).*</i>
18	Nervous system. Central nervous system.
19	Peripheral nervous system.
20	The Eye.
21	The Ear.
22	<b>Summary lesson № 4. Nervous and sensory systems.</b>
23	<b>Summary lesson № 4. Nervous and sensory systems. Practical part</b>
24	<i>Credit lesson.*</i>

## Second Semester.

#	Topic of the lab lesson
	<b>2<sup>nd</sup> semester</b>
1.	Skin and its Derivatives. Morphological bases of cutaneous, deep and visceral
2.	Cardiovascular System.
3.	Endocrine System.
4.	Immune Organs.
5.	<b>Summary Lesson 1. Special Histology and Embryology of regulatory systems.</b>
6.	General Structure of Digestive tube. Organs of Oral Cavity. Structure of the Lip. Tongue. Tonsils.
7.	Teeth. Structure and Development of Teeth. Large Salivary Glands.
8.	Pharynx, Esophagus, Stomach. Gastric glands. Histophysiology of digestion.
9.	General structure of Intestine. Morphological differences of the wall' structure of Small and Large Intestine.
10.	Liver and Pancreas.
11.	<b>Summary Lesson 2. Digestive system.-</b>
12.	General morphofunctional characteristics of respiratory organs. Conducting portion and respiratory portion.

<b>13.</b>	Kidneys and Urinary tract. Histophysiology of urine formation.
<b>14</b>	Male Reproductive system. General characteristics. Sources and course of development. Functions. Principles of regulation.
<b>15.</b>	Female Reproductive system. General characteristics. Sources of development. Functions. Principles of regulation. Ovarian-menstrual cycle: phases, regulation.
<b>16.</b>	Medial embryology. Nutrition of the embryo. Placenta: parts, structure, functional meaning. Structure and Function of Umbilical Cord.
<b>17.</b>	<b>Summary Lesson 3. Special Histology and Embryology of Respiratory, Urinary and Reproductive Systems. Medical Embryology.</b>

Duration of every lab lesson - 3 hours, total 122 hours.

## HISTOLOGY INDEPENDENT WORK

### First semester

№	Topic	Amount of hours
1	Histology in Ukraine. Research methods in histology. Histological techniques.	4
2	Structural bases of transport through cell membrane. Mechanisms of reception. Structural bases of cytoprotection.	6
3	Mitosis and Meiosis. Cell reaction to external stimuli.	4
4	Cleavage. Duration, localization, dark and light blastomeres. Blastocyst. Embryoblast. Embryonic stem cells.	4
5	The biological processes, which underlie the development of the embryo: induction, determination, division, cell migration, growth, differentiation, cell interaction, destruction.	6
6	<b>Preparation for final control of the Summary lesson 1.</b>	6
7	General principles of tissue organization. Epithelium as the leading component of histo-hematogenous barriers. Epithelial stem cells.	4
8	Thrombus formation. Stages and mechanisms.	4
9	Leukocytes. Mechanisms of adhesion, migration and killing of microorganisms. Interaction of blood cells and connective tissue during inflammation.	4
10	Reparation of loose connective tissue. Regulation of volume and composition of matrix of connective tissue.	6
11	Role of connective tissues with special properties in the development of autoimmune inflammatory processes.	4
12	<b>Preparation for final control of the Summary lesson 2.</b>	6
13	Articular cartilage.	4

14	Bones' rebuilding. Regeneration of bone tissue.	4
15	Muscle as organ. Muscles' regeneration. Histophysiology of locomotor apparatus.	4
16	Nerve endings. Nervous-muscle spindles.	6
17	<b>Preparation for final control of the Summary lesson 3.</b>	6
18	Development of cardiovascular system. Morphological bases of neurohumoral regulation of blood vessels activity.	4
19	Development of endocrine glands. Diffuse endocrine system. Trans- and parapituitary regulation.	4
20	Embryogenesis of hematopoietic organs. Cellular bases of nonspecific immunity. Cellular bases of the reactions of cell-mediated	4
21	<b>Preparation for summary lesson #4.</b>	6
22	Development of nervous system.	4
23	Regeneration of nerves.	4
24.	Preparation for credit lesson.	6

In total 120 hours.

## Second semester

### HISTOLOGY INDEPENDENT WORK

#	Topic	Amount of hours
	<b>Semester 2</b>	
1.	Histophysiology of the Eye.	5
2.	Histophysiology of the Ear.	5
3.	Hypothalamo – hypophyseal connections in the regulation	5
4.	Embryonic development of Digestive system.	5
5.	Connection between structural and functional peculiarities of Oral Cavity.	10
6.	Parietal and cavitary digestion.	5
7.	Correlation between morphology and functional peculiarities of Liver.	10
8.	Air-blood barrier.	5
9.	Endocrine function of Kidney.	10
10.	Spermatogenesis – hormonal regulation.	10
11.	Correlation between ovarian and menstrual cycles.	10
	<b>In total</b>	<b>80</b>

**Total duration of independent work – 200 hours.**

**9. Individual tasks:** writing papers, preparing presentations, making visual training aids (tables, posters, histological preparations)

**10. Tasks for independent work:**

preparation of reports or presentations on themes from Table 8 "independent work"

**11. Teaching methods:** survey students with an explanation of the key issues of the subject, answer questions students master the practical skills

**12. Methods of control:** control test, oral examination, a written response to questions teacher

13. The form of the final control of the success of training, control of practical skills (working with a microscope, histological diagnosis drugs, electronic micrographs), test control, a written response to questions from the ticket

**14. Shema calculation and distribution points that get students:**

For subjects which form the final control test is:

The maximum number of points that a student can collect for current educational activity at the study course is 200 points.

The minimum number of points that a student must collect for current educational activity for enrollment course is 120 points.

Calculating the number of points is based on student assessments received by 4-point scale (national) scale in the study subjects, by calculating the arithmetic mean (CA), rounded to two decimal places. The resulting value is converted into points by multi-scale as follows:

For convenience, a table converted 200-point scale:

Recalculation of the average score for current activity in multimark scale for courses that are completed by test

For subjects which form the final control is examination (differentiated test):

The maximum number of points that a student can collect for current educational activity for admission to the examination (differentiated test) is 120 points.

The minimum number of points that a student must collect for current educational activity for admission to the examination (differentiated test) is 72 points.

Calculating the number of points is based on student assessments received by 4-point scale (national) scale in the study subjects, by calculating the arithmetic mean (CA), rounded to two decimal places. The resulting value is converted into points by multi-scale as follows:



For convenience, a table converted 200-point scale:

$$x = \frac{CA \times 120}{5}$$

Recalculation of the average score for current activity in multimark scale for subjects that completed exam.

For subjects which form the final control is examination (differentiated test):

The maximum number of points that a student can collect for current educational activity for admission to the examination (differentiated test) is 120 points.

The minimum number of points that a student must collect for current educational activity for admission to the examination (differentiated test) is 72 points.

Calculating the number of points is based on student assessments received by 4-point scale (national) scale in the study subjects, by calculating the arithmetic mean (CA), rounded to two decimal places. The resulting value is converted into points by multi-scale as follows:

For convenience, a table converted 200-point scale:

Recalculation of the average score for current activity in multimark scale for subjects that completed exam/

Independent work of students is assessed during the current control of theme on the proper lesson. The acquisition of the topics to be considered only on independent work is controlled at the final control.

**The maximum number of points that a student can collect in the preparation of the exam is 80.**

The minimum score in the preparation of the exam - at least 50.

Assessment of discipline, culminating exam is defined as the sum of scores for current educational activity (at least 72) and points on the exam (at least 50).

Assessment of discipline, which ends Differentiated test is defined as the sum of scores for current educational activity (at least 72) and individual performance scores for tests at the last lesson (at least 50).

Points are converted regardless of discipline both in scale ECTS, and 4-point (national) scale. Score scale ECTS 4-point scale not converted and vice versa.

Scores of students are enrolled in one specialty, taking into account the number of points gained in the discipline ranked on a scale ECTS as follows:

### **Assessment ECTS statistic**

A best 10% of students

In the next 25% of students

C Next 30% of students

D Next 25% of students

E Last 10% of students

Ranking of assigning ratings of "A", "B", "C", "D", "E" is held for the students of this course, studying at one of the specialty and successfully completed the study subjects. Students who have received assessment FX, F («2») is not made to the list of students who ranked. Students from assessment after retaking FX are automatically mark "E".

Scores of discipline for students who successfully completed the program, converted into traditional 4-point scale by absolute criteria listed in the table below:

### **Scores of discipline Score 4-point scale**

From 170 to 200 points 5

From 140 to 169 points 4

From 139 points for the minimum number of points that a student must score 3

Below the minimum number of points that a student must collect 2

Assessment ECTS in traditional scale is not converted because the scale of ECTS and independent four-point scale.

Objectivity evaluation of educational activities of students tested statistical methods (correlation coefficient between the assessment and evaluation of ECTS national scale).

**15. Supportive (learning content)**, or extended outline plan of lectures, practical training plans, tasks for independent work, issues, tasks, objectives for current and final control of knowledge and skills of students

## 16. Suggested Reading

### **The main (basic)**

1. Lutsyk OD, Ivanov AI, KS Kabak, Tchaikovsky YB, Histology rights. Textbook. Kyiv "book-plus", 2010. - 582 p.
2. Ed. E.F.Barynova, Yu.B.Chaykovskoho. Cytology and general embryology. Tutorial. Kyiv, NE "Medicine", 2010.- 216 p.
3. Ed. E.F.Barynova, Yu.B.Chaykovskoho. Special histology and embryology internal organs. Tutorial. Kyiv, NE "Medicine", 2013.- 471 p.

### **Support**

1. 1. Volkov KS, Pasyechko NV The ultrastructure of cells and tissues. Atlas. Ternopil. Ukrmedknyha, 1997.- 93 p.
2. Dyeltsova AI, Tchaikovsky JB, SB Gerashchenko Histology and embryogenesis of mouth. Tutorial. Ivano-Frankivsk, 1998.- 78 c.
3. Tchaikovsky YB, Sokurenko LM Histology, Cytology and embriolhiya. Atlas for independent work. Luck, 2006.- 152 p.
4. Ed. Afanasyeva YI, Yurynoy NA Histology, Tsitol embryolohyya.- Moscow, 1999.- 744 p.
5. Barinov EF and co-author. Atlas elektronnoy mykroskopyy in two volumes. Donetsk, v.1 - 1997, vol.2 - 1998.- v.1 - 228s., Vol.2 -272 p.
6. Bikovo VL General Cytology and histology. St. Petersburg, 1999.- 520 p.
7. Bikovo VL Chastnaya histology person. St. Petersburg, 1997.- 300 p.
8. Sadler TV Medical Embryology at Lanhmanom. Lviv, "Nautilus", 2001.- 550S.

9. Kierszenbaum A.L., Tres L.L. Histology and Cell Biology.- Elsevier, Philadelphia, 2012.- 701 p.

10. Ross M.H., Pawlina W. Histology. A Text and Atlas.- Wolters Kluwer, Philadelphia, 2011.- 974 p.

## **17. Information Resources**

1. <http://reftrend.ru/604585.htm>

2. [http://nsau.edu.ru/downloads/library/ugebnik/gistologi/pages/frameset\\_book.htm](http://nsau.edu.ru/downloads/library/ugebnik/gistologi/pages/frameset_book.htm)

3. <http://www.meddean.luc.edu>

4. <http://histology.narod.ru/reference.htm>

5. <http://www.morphology.dp.ua>

6. <http://www.anatomyatlases.org/MicroscopicAnatomy>

7. <http://histologyatlas.wisc.edu>

8. <http://cytohistology.ua/>