

# SYLLABUS

## REGARDING THE QUALIFICATION CYCLE FROM 2024 TO 2030 ACADEMIC YEAR 2024/2025

### 1. BASIC COURSE/MODULE INFORMATION

Course/Module title	Histology, Embryology
Course/Module code *	HEC/B
Faculty (name of the unit offering the field of study)	Faculty of Medicine, University of Rzeszow
Name of the unit running the course	Department of Histology and Embryology
Field of study	Medical
Qualification level	Uniform Master studies
Profile	General academic
Study mode	Stationary / non-stationary
Year and semester of studies	1st year; 1-st and 2-nd semester
Course type	Obligatory
Language of instruction	English
Coordinator	Agata Wawrzyniak Assoc. Prof
Course instructor	Lecture and laboratory class Agata Wawrzyniak Assoc. Prof Seminar Pawel Porzycki MD, PhD

\* - as agreed at the faculty

### 1.1. Learning format – number of hours and ECTS credits

Semester (n0.)	Lectures	Classes	Laboratories	Seminars	Practical classes	Internships	others	ECTS credits
I	20	24	-	10	-	-		5
II	20	31	-	15	-	-		5
Both	40	55	-	25	-	-		10

### 1.2. Course delivery methods

X conducted in a traditional way

X involving distance education methods and techniques

### 1.3. Course/Module assessment (exam, pass with a grade, pass without a grade)

- 1st semester, lecture - pass without a grade
- 1st semester, laboratory class - pass with a grade
- 1st semester, seminar - pass with a grade
- 2nd semester, lecture - pass without a grade
- 2nd semester, laboratory class - pass with a grade
- 2nd semester, seminar - pass with a grade

## 2. PREREQUISITES

Basic knowledge in the field of biology
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## 3. OBJECTIVES, LEARNING OUTCOMES, COURSE CONTENT, AND INSTRUCTIONAL METHODS

### 3.1. Course/Module objectives

O1	Acquiring basic theoretical knowledge in the field of histology and embryology, such as the structure of tissues, systems, and organs of the human body, as well as the relationship between tissue structure and their functions.
O2	Familiarization with the mechanisms of organism formation during embryogenesis, the fundamental processes of system and organ development regulation, and the emergence of developmental defects
O3	Mastering practical skills in recognizing basic structural elements forming tissues under the microscope and identifying normal organs in histological specimens.

### 3.2. COURSE/MODULE LEARNING OUTCOMES (TO BE COMPLETED BY THE COORDINATOR)

Learning Outcome	The description of the learning outcome defined for the course/module	Relation to the degree programme outcomes
<b>KNOWLEDGE: THE GRADUATE KNOWS AND UNDERSTANDS:</b>		
LO_01	Knows the structure of the human body from a topographical and functional approach, including the topographical relationships between individual organs, along with anatomical, histological, and embryological terminology;	AW1
LO_02	Knows cellular structures and their functional specializations;	AW2
LO_03	Knows the microarchitecture of tissues, the extracellular matrix, and organs;	AW3
LO_04	Knows the stages of human embryo development, the structure and function of fetal membranes and the placenta, the stages of development of individual organs, and the impact of harmful factors on the development of the embryo and fetus (teratogenic).	AW4
<b>SKILLS: THE GRADUATE IS ABLE TO:</b>		

LO_05	Operates an optical microscope, including the use of immersion.	A.U1.
LO_06	Recognizes histological structures corresponding to organs, tissues, cells, and cellular structures in images from optical or electron microscopes, and describes and interprets their structure, as well as the relationships between structure and function.	A.U2.
<b>SOCIAL COMPETENCES: THE GRADUATE IS PREPARED TO</b>		
LO_07	Identifies and recognizes personal limitations and performs self-assessment of deficiencies and educational needs.	K.05
LO_08	Uses objective sources of information.	K.07
LO_09	Draws conclusions from personal measurements or observations.	K.08

### 3.3. Course content (to be completed by the coordinator)

#### A. LECTURES

<b>Content outline - I-st semester</b>
1. Modern solutions in microscopy
2. Histological procedure - histological techniques in imaging the morphology of tissues and organs
3. Epithelial tissue. Definition and classification of epithelia. Common features of epithelial tissues. Simple and stratified epithelium - structure and place of occurrence. Modifications of the epithelial tissue structure depending on the function performed. Glands - types of construction and secretion
4. Connective tissue part I. General characteristics of connective tissues and their classification. The extracellular matrix of connective tissue: fiber and ground substance. Origin, structure and function of connective tissue cells. Embryonic connective tissues, connective tissue proper
5. Connective tissues part II.: Cartilage and bone. Cartilage: characteristics of the extracellular matrix, cartilage types, mechanical properties, nutrition and growth. Bone components - extracellular substance and cells: osteoblasts, osteocytes and osteoclasts. Bone plate, organization of spongy and compact bone. Bone vascularization. Osteogenesis (intramembranous ossification and endochondral ossification).
6. Connective tissues part III: Blood: plasma structure, characteristics and adaptation to the functions of the morphing elements of the blood. Hemopoiesis.
7. Muscle tissue. Classification and occurrence of muscle tissues. Characterization of the building blocks of particular types of muscle tissue. Structural-functional unit of striated muscle tissues. Molecular mechanism of contraction: T-system channels, sarcoplasmic reticulum; conductive cardiac cells. Myocyte structure
8. Nervous and glial tissue. The concept of a neuron, the characteristics of its cytoplasmic equipment. Nerve fibers: structure, classification and myelination. Construction, types of synapses, synaptic transmission. Construction, function and place of occurrence.
9. The Circulatory System. Vascular system. Morphological and functional characteristics of large blood vessels - muscular and elastic arteries, veins. Histological structure, types of capillaries and place of occurrence. Capillary beds, histological structure of the heart.
10. The Immune System and Lymphoid Organs. Cells involved in immune system: lymphocytes and their subpopulations, antigen presenting cells. Lymphoid tissue. The structure of lymphoid nodules. Structure and function of the lymph node. Spleen - white and red pulp structure and their functions. Thymus -structure and function as a central lymphatic organ.

<b>Content outline - II-nd semester</b>
1. The nervous system. Central nervous system: brain and spinal cord. White and gray matter, cerebral cortex and cerebellar cortex, meninges, choroid plexus. Peripheral nervous system: ganglia, nerves. completion
2. Digestive system part I - (oral cavity, lip, tongue, esophagus). Mucosa of the oral cavity and its regional differences. Histological structure of the lip. Tongue - papillae and glands. Structure and function of taste buds. Histological structure of the esophagus
3. Digestive system part II - (stomach, small, large intestine). Organization of the gastric mucosa, characteristics of the glands and their cellular composition. Small and large intestine, function adaptation (villi and intestinal crypts), segmental diversity of their structure.
4. Digestive system part III - (organs associated with the digestive tract –salivary glands, liver, gallbladder, pancreas - histological structure and functions).
5. Respiratory system. The conducting part: nasal cavity - characteristics of the mucosa including the olfactory membrane. Respiratory epithelium - cell types. Larynx, trachea, bronchial tree. The respiratory part: respiratory bronchioles, alveolar ducts, and alveoli. Pneumocyte types and their functions. Blood circulation.
6. Urinary system. Kidney - cortical and medullary part. Blood circulation. The concept of nephron and location of its parts within the renal parenchyma. Renal function: filtration, secretion, and reabsorption. Structure and function of ureters, bladder, and urethra.
7. The male reproductive system. Construction and function of testis. Seminiferous tubules, sperm-forming epithelium, sperm structure, interstitial tissue. The intratesticular ducts and the excretory genital ducts: epididymis, vas deferens, the accessory glands of the male reproductive tract: seminal vesicles, prostate gland, bulbourethral gland, penis
8. Female reproductive system. Histological structure of: ovary, ovarian follicles, corpus luteum, fallopian tube, uterus - mucosa and muscle, vagina). Ovarian and menstrual cycle.
9. Endocrine system. Pituitary gland - division into the glandular and nerve part. Classification of glandular cells. Nerve part. Functional relationship of the pituitary gland with the hypothalamus. Thyroid - the structure of the follicle, the structure of its cells and their production cycle, C cells. Parathyroid - histological structure and types of cells. Pineal gland. Adrenal gland: cortical part, division into layers and their function. Ultrastructural features of cells. Paraganglia - ganglia. Gastrointestinal hormones, gonad endocrine cells. DNES diffuse endocrine system / APUD system.
10. Skin. Histological structure of epidermis, dermis and subcutaneous tissue. Skin glands: sebaceous, sweat and mammary. Hair structure at the root level.

## **B. CLASSES, LABORATORIES, PRACTICAL CLASSES**

<b>Content outline - I-st semester</b>
1. Epithelial tissue – classification, structure, examples (simple epithelia: squamous, cuboidal, columnar, ciliated pseudostratified; stratified epithelia: squamous, transitional, columnar).
2. Connective tissues proper – classification, structure, examples (mesenchymal, gelatinous, loose fibrous, tendon, reticular, adipose).
3. Supporting connective tissues: cartilage (hyaline, elastic, fibrous) and compact lamellar bone.
4. Blood: structure and functions of blood cells (erythrocytes, leukocytes, thrombocytes). Red bone marrow. Hemopoiesis.
5. Muscle tissues. Classification, histological structure: skeletal striated muscle tissue, cardiac muscle tissue, cardiac conduction system, smooth muscle tissue. Mechanism of contraction.
6. Nervous tissue. Histological structure, functions, and classification of neurons, neuroglia, choroid plexus.

7. Circulatory system (histological structure of large blood vessels: elastic artery, muscular artery, lymphatic vessels; morphological differences in the structure of arteries and veins; histological structure and types of capillaries).
8. Lymphatic-immune system. Histological structure and functions of lymphatic nodules, central lymphatic organs (child's thymus and involuted thymus), and peripheral organs (palatine tonsil, lymph node, spleen).
9. Credit of winter semester slides.

<b>Content outline - II-nd semester</b>
1. Histological organization of the nervous system. Histological structure of the central and peripheral nervous system: gray and white matter, cerebral cortex, cerebellar cortex, spinal cord, nerve fibers, ganglion, nerve trunk..
2. Digestive system, part I. Histological structure of the oral cavity, tongue, and papillae, taste buds, esophagus, and tooth.
3. Digestive system, part II. Transition from esophagus to stomach, histological structure of the stomach, small intestine, and large intestine, including morphological differences, appendix.
4. Digestive system, part III. Histological structure and function of major digestive glands: salivary glands (parotid, sublingual, submandibular), liver, gallbladder, pancreas.
5. Respiratory system. Histological structure and function of the air-conducting pathways: nasal cavity, larynx, trachea, bronchi. The true gas exchange organ – histological structure of the lungs (respiratory portion: respiratory bronchioles, alveolar ducts, alveoli), gas exchange, blood-air barrier.
6. Urinary system. Histological structure of the kidneys, nephron, juxtaglomerular apparatus, and urinary excretory pathways (ureter, bladder, male and female urethra).
7. Female reproductive system. Histological structure and function of the female gonad (cortex: ovarian follicles, corpus luteum, corpus albicans; medullary-vascular part), histological structure of the fallopian tube and uterus, with particular emphasis on the endometrium and myometrium, histological structure of the vagina.
8. Male reproductive system. Histological structure and function of the male gonad, epididymis, vas deferens, penis, and accessory glands: seminal vesicles, prostate.
9. Endocrine glands. Histological structure and function of the pituitary gland, pineal gland, thyroid, parathyroid, adrenal glands.
10. Skin and its appendages. Histological structure and function of hairy and non-hairy skin, hair, glands: sebaceous, sweat (eccrine, apocrine), mammary. Encapsulated receptor Vater-Pacini.
11. Credit of summer semester slides.

**SEMINARS**

<b>Content outline - I-st semester</b>
1. Organizational matters. Introduction to embryology. Basic concepts and embryological terminology. Gametogenesis: (oogenesis, spermatogenesis); sexual cycle (ovarian, menstrual), hormonal regulation of the sexual cycle.
2. Fertilization. Cleavage. Implantation. Weeks 2–4 of embryonic development.
3. Fetal period: from the 9th week of fetal life to birth. Congenital defects.
4. Structure and function of the placenta. Fetal membranes.
5. Development of the musculoskeletal system, skin, and its appendages. Molecular mechanisms regulating somite differentiation and segmentation, and the formation of bones and muscles. Development of the skull, limbs, spine, and skeletal muscles. Selected congenital defects of the skeletal and muscular systems.

### Content outline - II-nd semester

1. Development of the skin and its appendages. Derivatives of neural crests. Molecular control of skin and appendage development. Some developmental disorders of the skin and its appendages. Development of the head and neck: development of the pharyngeal apparatus – pharyngeal arches, grooves, and pouches. Molecular control of the development of the face, nasal cavity, oral cavity, tongue, as well as the thyroid and salivary glands. Selected developmental defects of the head and neck regions.

2. Development of the digestive and respiratory systems. Differentiation of the conducting and respiratory portions of the respiratory system, formation of the lungs and bronchial tree. Formation of body cavities: thoracic cavity, abdominal cavity, diaphragm, and mesentery. Some congenital defects of the respiratory system and developmental disorders in the formation of body cavities. Formation of the digestive system. Embryo folding, development, and differentiation of the foregut; formation of the stomach, liver, gallbladder, pancreas, and spleen. Formation of the midgut (intestinal loop, intestinal epithelium, intestinal wall, innervation) and hindgut. Selected developmental defects of the digestive system.

3. Development of the urinary and genital systems. Molecular control of urinary system formation; pronephros, mesonephros, and metanephros. Formation of the ureters, urinary bladder, urethra, and prostate gland. Development of the genital system; mechanisms and signaling controlling the formation of gonads (male and female), development of internal and external genital organs. Selected congenital defects of the urinary and genital systems.

4. Development of the heart and blood vessels. Formation of the arterial and venous systems. Fetal circulation and its changes in the perinatal period. Development of the lymphatic vessels. Some anomalies of the cardiovascular system.

5. Development of the nervous system: central (CNS) and peripheral (PNS), sensory organs, structure and function of the eye and ear. Major processes and signaling involved in the formation of the nervous system. Differentiation and segmentation of the neural tube. Development of the spinal cord and brain vesicles. Formation of the PNS. Selected congenital defects of the CNS and PNS.

### 3.4. Methods of Instruction

*e.g. Lecture: a problem-solving lecture/a lecture supported by a multimedia presentation/ distance learning*

*Classes: text analysis and discussion/project work (research project, implementation project, practical project)/ group work (problem solving, case study, discussion)/didactic games/ distance learning*

*Laboratory classes: designing and conducting experiments*

**Lecture:** lecture with multimedia presentation, providing students with in-depth scientific knowledge in the field of histology and embryology, solving research problems.

**Seminars:** multimedia presentation, discussion, group work, preparation of a research problem and research methodology based on scientific publications, searching and collecting literature data on the basis of scientific publications, working with databases.

**Laboratory classes:** theoretical introduction with multimedia presentation, work with a microscope, group work, discussion, participation in planning and performing experiments - handling of basic equipment in the histological laboratory equipment, development of experimental results, statistical analysis, formulation and analysis of applications, participation in the writing of publications scientific and preparation of the conference message.

**Case center** - a database of histological preparations

### 4. Assessment techniques and criteria

## 4.1 Methods of evaluating learning outcomes

Learning outcome	Methods of assessment of learning outcomes (e.g. test, oral exam, written exam, project, report, observation during classes)	Learning format (lectures, classes,...)
LO-01- LO-04	Final exam	L, C
LO-01- LO-09	Test on a specific part of the material; practical assessment	C
LO-01- LO-07	Test on a specific part of the material	S

## 4.2 Course assessment criteria

<p>The lectures end with a credit, all other forms of classes with a grade. Final credits and exams will be held in a traditional form.</p> <p><b>Lecture</b> Attendance at lectures is mandatory Lecture messages required in tests.</p> <p><b>Seminars</b> - credit with an assessment including</p> <ol style="list-style-type: none"> <li>Attendance at seminars is mandatory.</li> <li>Grades from one test in the both semester.</li> <li>Evaluation for the prepared multimedia presentation</li> </ol> <p>Range of ratings: 2.0 -5.0</p> <p>Laboratory Class - pass with a passing grade:</p> <ol style="list-style-type: none"> <li>Student's skills - recognition of histological slides.</li> <li>Attendance at laboratory class is mandatory.</li> <li>Grades from 2 tests and 1 practical assessment in the winter semester, as well as from 3 tests and 1 practical assessment in the summer semester. A test consisting of single-choice or multiple-choice questions. For each test, there is only one resit date. In the event of not receiving a passing grade, upon obtaining the Dean's approval, the student must retake the entire semester before a committee. Each test consists of at least 15 single-choice or multiple-choice questions.</li> <li>Correctly completed exercise notebook.</li> <li>Activity on laboratory classes.</li> </ol> <p>Range of ratings: 2.0 - 5.0</p> <p>Knowledge assessment (laboratory class): Test - cover the practical part in the form of recognition of slides under the microscope and the theoretical part in the form of single-choice test questions, diagrams and open questions / oral answers</p> <p>5.0 - has knowledge of each of the contents of education at the level of 90% -100%</p> <p>4.5 - has knowledge of each of the content of education at the level of 84%-89%</p> <p>4.0 - has knowledge of each of the content of education at the level of 77%-83%</p> <p>3.5 - has knowledge of each of the content of education at the level of 70%-76%</p> <p>3.0 - has knowledge of each of the content of education at the level of 60%-69%</p> <p>2.0 - has knowledge of each of the contents of education below 60%.</p> <p><b>Skill assessment:</b></p> <p>5.0 - the student actively participates in the classes, is well prepared in the field of the theory of the current material, correctly interprets the relationships between the structure and function of the tissues, organs and systems in question, correctly recognizes the basic structural elements under the microscope and correctly recognizes organs on histological slides,</p>
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4.5 - the student actively participates in the classes, with a little help from the teacher, correctly interprets the mechanisms, correctly recognizes the basic structural elements under the microscope and correctly recognizes the organs on histological preparations,  
4.0 - the student actively participates in the classes, not always able to solve the problem himself, correctly recognize the basic structural elements under the microscope and recognize organs on histological slides, performs these activities with the help of the teacher,  
3.5 - the student participates in the classes, its scope of preparation does not allow for a comprehensive presentation of the problem in question, draws incorrect conclusions and incorrectly recognizes the basic structural elements under the microscope and correctly recognizes organs on histological preparations,  
3.0 - the student participates in the classes, formulates conclusions that require correction on the part of the teacher, making minor mistakes, not fully understanding the dependencies and cause-and-effect relationships, makes a lot of mistakes when recognizing the basic structural elements under the microscope and correctly recognizing organs on histological slides,  
2.0 - the student passively participates in the classes, the statements are factually incorrect, do not understand the problems, recognize the basic structural elements and organs on histological slides incorrectly under the microscope

**Final exam**

Subject Histology and Embryology ends the exam in the summer session, which consists of two parts: the practical and theoretical exam. To take the exam, include all the laboratory and seminars positively

The final course grade is the arithmetic mean of the pass marks obtained by the student in the practical and theoretical exams.

**Practical exam**

Recognition of 15 slides under the microscope. The time to recognize the slide is 1 minute. Achieving 60% correct answers means passing the practical part of the examination.

**Exam evaluation criteria practical:**

- 5.0 - (15 points),
- 4.5 - (14 points.),
- 4.0 - (12-13 points.),
- 3.5 - (11 points.),
- 3.0 - (9-10 points.),
- 2.0 - less than 9 points

**Passing the practical exam is the condition accession to the theoretical exam**

**Theoretical exam :**

**Passing the practical exam is the condition accession to the theoretical exam**

**Theoretical exam:**

A test consisting of 100 single-choice or multiple-choice questions covering topics in histology and embryology from the content of lectures, seminars, and laboratory classes. The test takes 100 minutes.

- The test consists of 100 questions (single-choice or multiple-choice).
- All students leave bags in a place specifically for this purpose.
- During the exam, the student may only carry a pen. Mobile phones must be turned off.
- Each attempt to communicate between students and cheat, will be punished. In this situation the student receives a grade of 2.0
- Students stay in their places until the exam is over.

Any comments on the test, including the correctness of the questions, can only be made during the test by raising the hand and reporting the question or problem to the examiner. Comments to the substantive content of the questions are submitted in during the test on a special sheet.

Reported comments are considered by the course coordinator or the teachers. Students are informed about the result of the analysis of the submitted comments via the Virtual University



portal or in person by the course coordinator. In the event of a substantive error: Question will be cancellation and percentage thresholds are calculated against the new number of questions. Unauthorized absence from the exam results in a 2.0. Absence from the examination may be excused only with a rector's / dean's or medical leave presented within 3 days from the date of the examination to the Dean's Office and the Department of Histology and Embryology. Failure to be released within this period results in receiving a failing grade.

Students who have obtained an average of 5.0 in all tests, seminars and classes in a given academic year are allowed to take the zero exam

**Exam evaluation criteria theoretical:**

5.0 - shows knowledge of each of the content of education at the level of 93% -100%

4.5 - shows knowledge of each of the content of education at the level of 85% -92%

4.0 - shows knowledge of each of the content of education at the level of 77% -84%

3.5 - shows knowledge of each of the content of education at the level of 69% -76%

3.0 - shows knowledge of each of the content of education at the level of 61% -68%

2.0 - shows knowledge of each of the content of education below 60%.

**5. Total student workload needed to achieve the intended learning outcomes – number of hours and ECTS credits**

Activity	Number of hours
Course hours	120
Other contact hours involving the teacher (consultation hours, examinations)	30
Non-contact hours - student's own work (preparation for classes or examinations, projects, etc.)	150
Total number of hours	300
Total number of ECTS credits	10

\* One ECTS point corresponds to 25-30 hours of total student workload

**6. Internships related to the course/module**

Number of hours	-
Internship regulations and procedures	-

**7. Instructional materials**

Compulsory literature:

1. Junqueira's Basic Histology - Text and Atlas, Anthony L. Mescher. Edition: 16th, 2021, Publisher: McGraw-Hill Medical

2. Medical Embryology. Sadler T. W. Langman's, 14th Edition, 2018.

3. Wawrzyniak A. Histology exercise notebook for students of Faculty of Medicine, College of Medical Sciences, University of Rzeszów, 2024

Complementary literature:

1. Essential Cell Biology 3rd Edition, Bruce Alberts, Edition: 3rd, 2009, Publisher: Garland Science
2. Wheatear's Functional Histology - A Text and Colour Atlas, Barbara Young, Phillip Woodford, Geraldine O'Dowd, Edition: 6th, 2013, Publisher: Churchill Livingstone

Approved by the Head of the Department or an authorised person