


Ministry of science and high education RF Ulyanovsk State University Faculty of Medicine named after Biktimirov T.Z., IMEiPC	Form	
F-Educational plan of the discipline		



**APPROVED**  
 by the decision of the Academic Council of the USU Institute of Medicine,  
 Ecology and Physical Culture  
 June « 19 » 2019, № 10/210  
 Chairman V.I. Midlenko  
*(signature, signature clarification)*  
 « 19 » of June 2019.

### EDUCATIONAL PLAN

Subject	Embryonic development of body tissues
Faculty	Medical
Department	Morphology
Course	1

Specialty 31.05.01. «General medicine»  
*(code of the specialty, full name)*

Form of education- full-time education

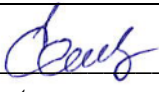
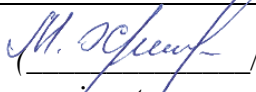
Date of introducing in the instruction process at USU: « 1 » of September 2019.


The program was updated at the meeting of the department: № \_\_\_ of \_\_\_ 20\_\_.

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Information about the authors:

Initials	Abbreviation of the department	Degree, scientific rank
Slesareva Elena Vasilievna	Morphology	Professor, MD, Associate Professor
Kuznetsova Tatyana Ivanovna	Morphology	Associate Professor, Ph.D.

Agreed	Agreed
Head of department, developing discipline	Head of the graduating Department
 _____ /Slesareva E.V./ <i>Signature</i> « 19 » June 2019 yr.	 _____ /Vise-Chripunova M.A./ <i>signature</i> « 19 » June 2019 yr.

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### 1. OBJECTIVES AND AIM OF DISCIPLINE:

Objectives of mastering the discipline: Mastering the knowledge of the laws of progenesis and embryonic development of tissues and organs of the human body.

Tasks of mastering the discipline: Mastering the knowledge of the features of the morphological structure and functioning of human organs and tissues in various periods of intrauterine development.


### 2. PLACE OF THE SUBJECT IN THE STRUCTURE OF GEP:

Academic discipline "Embryonic development of body tissues" refers to block 1, its variable part - compulsory curriculum disciplines. The discipline "Embryonic development of body tissues" provides the formation of fundamental theoretical knowledge of human embryogenesis, on the basis of which all the training of the future doctor is based. To study this discipline, a student must master such disciplines as "Anatomy", "Biology", "Latin". The discipline under study deepens and concretizes the knowledge gained in the study of "Histology, Embryology, Cytology", lays the foundation for the study of such disciplines as "Obstetrics and Gynecology", "Neonatology", "Fetal Anatomy", studying the formation of congenital malformations in the framework of " Pathological Anatomy. "

### 3. LIST OF EXPECTED RESULTS OF INSTRUCTION ON THE SUBJECT (UNIT), CORELATED WITH PLANNED RESULTS OF COMPLETING THE PROGRAM

The study of the subject «... » within the completion of the educational program is directed towards the formation of the following general and professional competences in students:

Competence index. Content of a competence (or a part of it)	The proposed results of the course students are:
GPC 9	<p><u>To know:</u></p> <ul style="list-style-type: none"> <li>- multilevel principle of the structure of the human body as a biological object and hierarchical relationships within it.</li> <li>- stages of embryonic and postembryonic development of the human body and their inherent structural features of cells, tissues and organs</li> </ul> <p><u>To be able to:</u></p> <ul style="list-style-type: none"> <li>- work with a magnifying technique (micro-scope)</li> </ul> <p><u>To own:</u></p> <ul style="list-style-type: none"> <li>- microscopy and "reading" of histological, histochemical and embryological preparations.</li> <li>- "Reading" of histological and embryological micrographs and drawings corresponding to the indicated preparations.</li> <li>- sketches of histological and embryological preparations.</li> </ul>

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#### 4. VOLUME OF THE SUBJECT

**4.1. Volume of the subject in credit points (total): 2 credit points**

**4.2. On types of academic workload (in hours):**

Type of academic work	Number of hours (form of education full-time)	
	Total according to the plan	Including on semesters
		2
Contact work of students with a teacher in accordance with syllabus		
Contact lessons:	54	54
Lectures	-	-
Workshops	54	54
Independent work	18	18
Concurrent control		Test, colloquium, summary, stand-ings
Types of intermediate certification (exam, test)		credit
Total hours for discipline	72	72


If it is necessary to use partially or exclusively remote educational technologies in the educational process, the table shows the number of hours of work of teaching staff with students for conducting classes in a remote format using e-learning.

**4.3. Contents of the discipline (module). Distribution of hours on themes and kinds of study:**


Number of hours –72

The form of training: full time

Name of sections and themes	Total	Activity format			Form of current control
		Classroom studies		Self-study work	
		Workshop	Inter-active classes		
Section 1. Early human embryogenesis					
1. Reproduction of cells.	6	6	-	-	Questions at the final lesson, stand-ings, interview
2. General ideas about human embryogenesis. Progenesis. Fertilization.	3	3	-	-	Questions in the final lesson, stand-ings. Job interview
3. The initial and embryonic periods of embryogenesis.	3	3	-	-	Questions in the final lesson, stand-ings. Interview
4. The formation and structure of extra-germ organs.	3	3	-	-	Questions in the final lesson, stand-ings. Interview

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5. Education and structure of the placenta.	3	3	-	-	Questions in the final lesson, standings. Interview
6. Final lesson on early embryogenesis	3	3	1	-	Interview
<b>Section 2. Embryonic tissue development</b>					
7. Hematopoiesis	3	3	-	-	Questions in the final lesson, standings, exam. Interview.
8. Embryonic histogenesis of connective tissues	3	3	-	-	Questions in the final lesson, standings, exam. Interview.
9. Embryonic histogenesis of muscle and nerve tissue	3	3	-	-	Questions in the final lesson, standings, exam. Interview.
10. Final lesson №2	3	3	1	-	Interview.
<b>Section 3. Embryonic development of organ systems</b>					
11. Embryonic development of the urinary system	3	3	-	-	Questions in the final lesson, standings, exam. Interview.
12. Male reproductive system	6	6	-	-	Questions in the final lesson, standings, exam. Interview.
13. Female reproductive system	6	6	-	-	Questions in the final lesson, standings, exam. Interview.
14. Embryogenesis of the sense organs	3	-	-	3	Questions in the final lesson, standings, exam.
15. Embryogenesis of the organs of the cardiovascular system	3	-	-	3	Questions in the final lesson, standings, exam.
16. The development of organs of the hematopoietic system	3	-	-	3	Questions in the final lesson, standings, exam.
17. The development of the organs of the endocrine system.	3	-	-	3	Questions in the final lesson, standings, exam.
18. The development of the digestive system	3	-	-	3	Questions in the final lesson, standings, exam.

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19. Respiratory system development	3	-	-	3	Questions in the final lesson, standings, exam.
20. Final lesson №3	3	3	1	-	Interview.
21. Diagnosis of drugs	3	3	1	-	Interview.
<b>TOTAL</b>	<b>72</b>	<b>54</b>		<b>18</b>	

#### **Interactive classes**

<b>№п/п</b>	<b>The name of the discipline section</b>	<b>Interactive classes</b>	<b>Duration (hour)</b>
1.	Final lesson №1	Work in small groups, training in determining histological preparations	1
2	Final lesson №2	Work in small groups, training in determining histological preparations	1
3	Final lesson №3	Work in small groups, training in determining histological preparations	1
4	Diagnosis of drugs by embryonic development	Training in determining histological preparations.	1
<b>TOTAL</b>			<b>4</b>

## **5. COURSE CONTENT**

### **Section 1.**

#### **EARLY EMBRIOGENESIS**

##### **Theme 1.**

##### **REPRODUCTION OF CELLS.**

The structure and functions of the nucleus of an animal cell. Mitotic cycle: characterization of inter-phase and mitosis phases. Cell life cycle. The concept of proliferation, proliferative pool. Amitosis. The mechanism of polyploidy. Cell response to damage. Regeneration.


##### **Theme 2.**

##### **GENERAL PROVISIONS ON HUMAN EMBRYOGENESIS.**

##### **PROGENESIS. FERTILIZATION.**

Periodization of human development. The idea of the biological processes underlying the development of the embryo is induction, determination, division, cell migration, growth, differentiation, cell interaction, cell death. Features of human embryonic development. Critical periods in development. Violation of the processes of determination as a cause of anomalies and deformities.

Progenesis. Spermatogenesis. Ovogenesis The structural features of gametes.

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Fertilization. Distant and contact interaction of germ cells. Transformation in sperm: capacitation, acrosomal reaction, penetration of the transparent zone and plasmalemma of the oocyte, discharge of the cytoplasmic membrane of sperm, formation of the male pronucleus.

Transformation in oocyte: scattering of radiant crown cells, cortical reaction, release of cortical granule enzymes, transformation of the transparent zone (zone reaction) end of meiosis, formation of reduction bodies.

Male and female pronuclei, the decay of their membranes, the establishment of a connection between the chromosomes of pronuclei with sperm centriole.

### **Theme 3.**

#### **INITIAL AND ANALYSIS PERIODS OF EMBRIOGENESIS.**

1 week of development. Zygote - a unicellular embryo, its genome, activation of intracellular processes. Splitting up. The specificity of crushing in humans. The structure of the embryo at different stages of crushing. The role of the transparent zone. Characterization of dark and light blastomeres. Reducing the size of blastomeres. Morula. Blastocyst. Embryoblast and trophoblast. Stage free blastocyst. The condition of the uterus at the beginning of implantation. the beginning of the 1st phase of gastrulation. Implantation. Differentiation of cytotrophoblast and syncytiotrophoblast. The formation of gaps. Histiotrophic type of nutrition, the formation of primary and secondary chorionic villi.

2 week of development. Gastrulation Separation of the embryoblast into epiblast and hypoblast, formation of the yolk bladder. Transformation of the embryoblast, the formation of an amniotic bladder. The beginning of the 2nd phase of gastrulation is the formation of the primary strip and the primary nodule, the formation of the mesoderm, ectoderm of the embryo, and the prechordal plate.

3rd week of development. Differentiation of the germinal mesoderm, chord formation. The formation of the neural tube and neural crest. The body fold, the formation of the primary intestine.

### **Theme 4-5.**

#### **STRUCTURE OF EXTERNAL BODIES.**

Placenta. Chorion. The formation, organization features of the maternal and fetal components and their change during pregnancy. Structural differences in villi in different trimesters of pregnancy. The functions of the placenta.

Amnion, its structure and significance. Yolk Sack. Sources of development, structure. Allantois, its structure and significance. The umbilical cord, its formation and structure: mucous tissue, blood vessels, vestiges of the yolk sac and allantois. The mother-placenta-fetus system and its physiology.


### **Theme 6. HEMOPOESIS**

Fetal hematopoiesis. Mesoblastic stage. Hematopoiesis in the wall of the yellow sac and chorion. Erythropoiesis, megaloblastic and normoblastic erythropoiesis. Granulocytopoiesis.

Hepatic phase. Hematopoiesis in the liver, thymus, spleen and lymph nodes.

Blood formation in the red bone marrow. The beginning of hematopoiesis, its versatility. Postembryonic hematopoiesis. Erythropoiesis, granulocytopoiesis, monocytopenoiesis, thrombocytopoiesis, lymphopoiesis and immunopoiesis.

### **Theme 7. EMBRYONAL HISTOGENESIS OF CONNECTIVE TISSUES**

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Loose connective tissue. Fetal source of fibroblasts. The time of formation of the intercellular substance. The state of connective tissue in newborns.

Embryonic chondrohistogenesis. Fetal source. Stage of chondrogenic islet. Stage of formation of primary cartilage, signs of its immaturity. Stage of differentiation of cartilage tissue. Cartilage formation and its further growth.

Fetal osteogenesis. His views. Direct osteohistogenesis and flat bone formation. The formation of a skeleton islet. Osteoid stage, the formation of a connective tissue model of coarse fibrous bone tissue. Stage of ossification (calcification). The formation of the primary cancellous bone, its structure. Replacing coarse-lobed bone tissue with lamellar and secondary spongy bone formation.

Indirect osteohistogenesis. The formation of a cartilaginous model of the future tubular bone. Replacement of cartilage tissue with coarse-fiber bone tissue; the formation of a perichondral bone cuff (perichondral ossification), dystrophy of hyaline cartilage, enchondral ossification. The spread of the process of ossification in the direction of the pineal glands. The formation of the diaphyseal center of ossification. Replacement of coarse-fibrous bone tissue with lamellar: destruction of coarse-fibrous bone tissue, the formation of osteons, external and internal common laminae, and the formation of a compact bone substance. Replacement of coarse-fibered bone tissue with lamellar in epiphysics, formation of spongy bone substance.

### **Theme 8. EMBRYONAL HISTOGENESIS OF MUSCULAR AND NERVOUS TKA-HER**

Skeletal muscle tissue. The embryonic source of the formation of symplasts (myotube, differentiation of myotubes - their transformation into mysymplasts: the development of granular EPS, the formation of myofibrils, the structural organization of the mysymplast. Cardiac muscle tissue. The embryonic source. Differentiation of cardiomyocytes: contractile (working), pacemous conducting secretory.

Histogenesis of smooth muscle tissue of mesenchymal origin.

Embryonic source, formation of the neural plate, neural crest and neural tube. The structure of the neural tube, the differentiation of neurons and neuroglia.

### **Section 3. Embryonic development of organ systems**

#### **Theme 9. DEVELOPMENT OF THE URINARY SYSTEM**

General morphological and functional characteristics of the urinary system. Laying of the kidneys, primary and permanent kidney. The formation of the ureters, pelvis, calyx and collecting ducts. The formation of the bladder from the urogenital sinus.

#### **Theme 10. DEVELOPMENT OF BODIES OF THE MAN'S REPRODUCTIVE SYSTEM**

Fetal sources. Indifferent stage of development of the gonad.


Differentiation of the indifferent sexual gland into the male. The formation of the seminiferous tubules, the network of the testis, the formation of efferent seminiferous tubules, the epididymis of the testis, vas deferens and seminal vesicles. Embryonic source and development of the prostate gland.

The structure of the testes and additional organs of the male reproductive system.

#### **Theme 11. DEVELOPMENT OF BODIES OF THE FEMALE GENITAL SYSTEM**

Differentiation of an indifferent sexual gland into a female. Separation of the inferential gland from the mesonephronal duct and its reduction. Separation of sex cords into segments, the



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formation of primordial follicles from them. Differentiation of ovogony into 1st order oocytes. The development of the oviducts, uterus, vagina.

The structure of the ovaries and additional organs of the female reproductive system. Ovarian-menstrual cycle. The structure of the mammary glands.

### **Theme 12. EMBRIOGENESIS OF SENSITIVITY**

Eye development. Fetal sources. The development of the optic glass and the formation of the retina. The formation of the lens placode and the development of the lens. The formation of the membranes of the eye and their derivatives.

Embryonic sources and the development of organs of smell and taste.

Organ of hearing. Embryonic source of the inner ear. The formation of the vestibule and the maze. Differentiation of the Corti organ and the organ of equilibrium.

### **Theme 13. EMBRIOGENESIS OF THE BODIES OF THE CARDIOVASCULAR SYSTEM**

The development of blood vessels. Blood islands in the wall of the yolk sac and the formation of endothelial tubes. The formation of endothelial tubes in the body of the embryo. Differentiation of the endothelial tube network into arteries, veins, capillaries. Desolation of the primary network of capillaries and the formation of definitive.

Heart development. Fetal source, heart laying. The formation of arterial cone and venous sinus. Turning them into the ventricle and atrium. The formation of interventricular and interatrial septa. Violation of their education, as the cause of congenital heart defects.

Differentiation of cardiomyocytes, the formation of the conduction system of the heart.

### **Theme 14. DEVELOPMENT OF BODIES OF THE BLOOD SYSTEM**

Red bone marrow. The formation of osteoblastic bone marrow. The population of its stem blood cells, the beginning of hematopoiesis.

Thymus. The embryonic source, the course of the bookmark, the onset of lymphocytopoiesis, its development during the embryonic period.

Spleen. Fetal source, bookmark. The development of hematopoiesis, its change in the process of embryogenesis.

Lymph nodes The accumulation of mesenchymal cells around the blood and lymph vessels. The formation of the subcapsular sinus and trabeculae. The formation of lymph nodes and brain cords. The formation of the paracortical zone.

### **Theme 15. DEVELOPMENT OF BODIES OF THE ENDOCRINE SYSTEM.**

Pituitary. The formation of the pituitary pocket and protrusion of the intermediate cerebral bladder. Differentiation of the pituitary pocket. Education neurohypophysis.


Thyroid. Embryonic embryo, the course of embryonic development, follicle formation. Parathyroid glands. Fetal source. The course of embryonic development.

Adrenal glands. Fetal source. Bookmark the primary and secondary cortex, formation of the medulla of the adrenal glands.

### **Theme 16. DEVELOPMENT OF BODIES OF THE DIGESTIVE SYSTEM**

Digestive tube development. Changing the shape of the digestive tube. The development of the epithelium of the esophagus, the laying of its glands. Changing the shape of the bookmark of the stomach, the development of the glands of the stomach.



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The formation of the small and large intestines. The development of the parotid glands. Over-laying of the parotid glands. Development of excretory ducts and end sections.

Liver. The formation of the liver bay. Differentiation of the anterior wall and formation of hepatic beams. Differentiation of the posterior wall, the formation of the gallbladder and its duct. The formation of the hepatic bile duct and common bile duct.

Pancreas. Fetal sources. The development of ducts, end sections, endocrine islets.

### **Theme 17. DEVELOPMENT OF RESPIRATORY SYSTEM BODIES**

Fetal source. Bookmark the larynx and trachea. The formation of lung bags. The formation of the primordia of the bronchi and the development of the bronchial tree. The development of re-spiral bronchioles.

## **6. TOPICS OF PRACTICAL LESSONS AND SEMINARS**

### **Section 1. Early human embryogenesis.**

#### **Lesson 1. Introductory lesson.**

Safety briefing.

The subject and objectives of the study of embryology.

Methods used in embryological research.

The history of embryology.

Rules for working with a microscope.

#### **Lesson 2. Reproduction of cells.**

The structure and functions of the nucleus of an animal cell.

Mitotic cycle: characterization of interphase and phases of mitosis.

Cell life cycle.

The concept of proliferation, proliferative pool.

Amitosis. The mechanism of polyploidy.

Cell response to damage. Regeneration.


Examine under a microscope: mitosis in the root of the onion, mitosis of enterocytes in the crypts of the small intestine.

#### **Lesson 3. General provisions on human embryogenesis. Progenesis.**

Fertilization

1. The periods of human development.
2. The biological processes underlying the development of the embryo - induction, determination, division, cell migration, growth, differentiation, cell interaction, cell death.
3. Critical periods in human development.
4. The structure of the sperm and egg.
5. Spermatogenesis.
6. Ovogenesis.
7. Fertilization. Distant and contact interaction of gametes.
8. Capacitations, acrosomal reaction.
9. The penetration of the sperm into the egg.

Examine the structure of the sperm and the egg under a microscope. To study the stages of spermatogenesis and ovogenesis.

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#### **Lesson 4. The initial and embryonic periods of embryogenesis**

1. Crushing.
  2. Type of crushing in humans.
  3. The role of the shell of fertilization.
  4. Morula, the day of education.
  5. Blastocyst, day of formation, structure.
  6. Stage free blastocyst.
  7. Implantation.
  8. Gastrulation, 1st and 2nd phase. Bookmark extra-germ organs.
  9. Differentiation of germ layers
- Examine under a microscope the blastocyst, the 1st and 2nd phase of gastrulation.

#### **Lesson 5. The structure of extra-germ organs.**

1. Amnion, its structure, functions.
  2. The structure and functions of the yolk sac.
  3. The structure and functions of allantois.
  4. The development of chorion, its participation in the formation of the placenta.
- To study under a microscope the structure of the amniotic membrane, the structure of the umbilical cord.

#### **Lesson 6. The structure of extra-germ organs.**

1. The formation of the placenta.
  2. The structure of the fetal part of the placenta.
  3. The structure of the maternal part of the placenta.
  4. The structure of the chorionic villi.
  5. The functions of the placenta.
  6. The structure of the umbilical cord.
- Examine under the microscope the structure of the fetal and maternal parts of the placenta.  
To study the structure of the chorionic villi.

#### **Lesson 7. Final lesson on early embryogenesis.**


#### **Section 2. Embryonic tissue development.**

#### **Lesson 8. Hemopoiesis**

1. Mesoblastic stage of hematopoiesis.
  2. The hepatic stage of hematopoiesis.
  3. Blood formation in the red bone marrow.
  4. Postembryonic hematopoiesis.
- Examine under the microscope the laying of the hematopoietic islets in the mesenchyme of the yolk sac. Examine the hematopoietic series according to the table.

#### **Lesson 9. Embryonic histogenesis of connective tissues**

1. Embryonic development of loose connective tissue.
2. Embryonic chondrohistogenesis.
  - Stage chondrogenic islet.
  - Stage of primary cartilage tissue formation.
  - Stage of differentiation of cartilage tissue.
3. Direct osteogenesis.

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#### 4. Indirect osteohistogenesis.

Examine direct and indirect osteogenesis under a microscope.

#### **Lesson 10. Embryonic histogenesis of muscle tissue and nervous tissue.**

1. The development of skeletal muscle fiber.
2. The development of cardiac muscle tissue.
3. Histogenesis of smooth muscle tissue of mesenchymal origin.
4. The development of nervous tissue, the laying of the main organs of the nervous system

Examine under a microscope the structure of the myotube, the stage of laying the neural tube and neural crest.

#### **Lesson 11 The final lesson on histogenesis and initial organogenesis.**

#### **Section 3. Embryonic development of organ systems**

#### **Lesson 12 Urinary System Development**

1. Bookmark the forearm.
2. The formation of the primary kidney.
3. The formation of the final kidney.
4. The formation of the ureters, pelvis, calyx and collecting ducts.
5. The formation of the bladder.
6. The general plan of the structure of the urinary system.

Examine the development of the kidney and urinary system according to the table.

#### **Lesson 13. Development of the organs of the male reproductive system**

1. The indifferent stage of development of the sex gland.
2. Differentiation of the indifferent sexual gland according to the male type.
3. The development of the appendage of the testis, seminal vesicles and prostate gland.
4. Testis: structure, endocrine function.

Examine the structure of the testis under a microscope.

#### **Lesson 14. The structure of the additional organs of the male reproductive system.**

1. Spermatogenesis.
2. Vas deferens: direct tubules, testis network, vas deferens.
3. Seminal vesicles.
4. The prostate gland.
5. Penis


To study under a microscope the structure of the epididymis, prostate gland.

#### **Lesson 15. Development of the female reproductive system**

1. Differentiation of the indifferent sexual gland according to the female type.
2. The embryonic stage of ovogenesis.
3. Ovary: structure, ovogenesis, ovulation, corpus luteum.
4. Age-related changes.

Examine under the microscope the structure of the ovary, the structure of the corpus luteum.

#### **Lesson 16. The structure of the additional organs of the female reproductive system.**

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1. The structure and function of the oviducts and uterus.
  2. Ovarian-menstrual cycle.
  3. The structure of the vagina and external genitalia.
  4. Breast, embryogenesis, neuroendocrine regulation of development and function.
- Examine under a microscope the structure of the uterus, mammary gland.

### **Lesson 17. Final lesson on embryonic development of organ systems**

### **Lesson 18. DIAGNOSTICS OF SLIDES**


1. FURTHER PART OF THE PLACENTA
2. MOTHER OF THE PLACENTA.
3. BONE DEVELOPMENT FROM MESENCEPHALIS.
4. BONE DEVELOPMENT IN THE PLACEMENT OF THE CARTILAGE.
5. SEEDS
6. PROSTATE GLAND
7. SEEDDER ADDITION
8. OVARIAN
9. MAMMARY GLAND
10. UTERUS

**7. LABORATORY CLASSES** - This type of work is not provided by UP.

**8. SUBJECTS OF COURSE PAPERS, TESTS, ESSAYS** - This type of work is not provided by UP

Sample topics of abstracts:

- The development of the spinal cord and brain.
- Histological immaturity of the nervous system at the time of birth.
- Development of the organ of vision
- The development of the organs of smell and taste.
- Differentiation of the organ of Corti and the organ of equilibrium.
- Bookmark the heart and the development of the heart.
- Red bone marrow development
- Thymus development.
- The development of the spleen.
- The development of lymph nodes.
- Bookmark and differentiation of the pituitary gland
- The course of embryonic development of the thyroid gland.
- Bookmark the primary and secondary adrenal cortex.
- The development of the parotid salivary glands.
- The development of the liver.
- The development of the pancreas.
- Tooth development.
- The development of the bronchial tree.

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## 9. QUESTIONS FOR CREDIT ON DISCIPLINE


Sample questions for the offset on the course "Embryonic development of body tissues"

Early human embryogenesis.

1. The periods of human development.
2. The biological processes underlying the development of the embryo - induction, determination, division, cell migration, growth, differentiation, cell interaction, cell death.
3. Critical periods in human development.
4. The structure of the sperm and egg.
5. Spermatogenesis.
6. Ovogenesis.
7. Fertilization. Distant and contact interaction of gametes.
8. Capacitations, acrosomal reaction.
9. The penetration of the sperm into the egg.
10. What is crushing.
11. Type of crushing in humans.
12. The role of the shell of fertilization.
13. Morula, the day of education.
14. Blastocyst, day of formation, structure.
15. Stage free blastocyst.
16. Implantation.
17. Gastrulation 1st and 2nd phase. Bookmark extra-germ organs.
18. Differentiation of germ layers
19. The formation of the placenta.
20. The structure of the fetal part of the placenta.
21. The structure of the maternal part of the placenta.
22. The structure of the chorionic villi.
23. The functions of the placenta.
24. Amnion, its structure, functions.
25. The yolk sac, its structure, functions.
26. Alantois, its structure, functions.
27. The structure of the umbilical cord.


Embryonic tissue development.

28. Stages of the formation of stratified squamous non-keratinized epithelium.
29. Epithelium of the mucous membranes at the time of birth.
30. Mesoplastic stage of hematopoiesis.
31. The hepatic stage of hematopoiesis.
32. Blood formation in the red bone marrow.
33. Embryonic development of loose connective tissue.
34. Embryonic chondrohistogenesis.
35. Direct osteogenesis.
36. Indirect osteogenesis.
37. The development of skeletal muscle fiber.
38. The development of cardiac muscle tissue.
39. Histogenesis of smooth muscle tissue of mesenchymal origin.
40. The formation of the neural tube and neural crest.
41. The structure of the neural tube.

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Embryonic development of organ systems

42. Education of the spinal cord.
43. The formation of the brain.
44. Differentiation of the ganglion plate.
45. Histological immaturity of the nervous system at the time of birth.
46. The development of the optic glass and the formation of the retina.
47. The formation of the lens placode and the development of the lens.
48. The formation of the membranes of the eye and their derivatives.
49. The development of the organs of smell and taste.
50. The formation of the vestibule and the labyrinth of the inner ear.
51. The differentiation of the organ of Corti and the organ of equilibrium.
52. Vascular development of extra-embryonic organs and the body of the embryo.
53. Differentiation of the endothelial tube network into arteries, veins, capillaries.
54. The laying of the heart and the development of the heart.
55. The transformation of the venous sinus into the atrium, and the arterial cone into the ventricle.
56. The formation of interventricular and interatrial septa.
57. Differentiation of contractile cardiomyocytes, the formation of a conduction system of the heart.
58. Red bone marrow development
59. Thymus development.
60. The development of the spleen.
61. The development of lymph nodes.
62. The formation of the pituitary pocket.
63. Differentiation of the pituitary pocket.
64. The formation of the neurohypophysis.
65. The course of embryonic development of the thyroid gland.
66. Bookmark the primary and secondary adrenal cortex.
67. Development of the parotid glands.
68. The development of the liver.
69. The development of the pancreas.
70. The development of the tooth germ.
71. The development of dentin and enamel.
72. Bookmark the larynx and trachea.
73. The development of the bronchial tree.
74. The development of pulmonary sacs.
75. Bookmark prepochki.
76. The formation of the primary kidney.
77. The formation of the final kidney.
78. The formation of the ureters, pelvis, calyx and collecting ducts. Bladder formation.
79. The indifferent stage of development of the sex gland.
80. Differentiation of the indifferent sexual gland according to the male type.
81. The development of the epididymis, seminal vesicles and prostate gland.
82. Differentiation of the indifferent sexual gland according to the female type. The embryonic stage of ovogenesis.

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## 10. SELF-STUDY WORK OF STUDENTS

№	Name of the section / subject	Types of SSW	Total number of hours	Current control
1.	Sense Embryogenesis	Sources of development. Differentiation of the eye glass, the development of photoreceptors. The formation of the vitreous body.	3	summary
2.	Embryogenesis of the organs of the cardiovascular system	Transformation of the auditory vesicle. Differentiation of auditory receptor cells and supporting cells.	3	summary
3.	The development of hematopoiesis	Sources of development. Transformation of endothelial tubes into arteries, veins and capillaries. Bookmark heart. Transformation of the venous sinus into the atrium. Transformation of the arterial cone into the ventricle. Replacement of the primary atrial septum with a secondary, its violation. Causes of heart defects.	3	summary
4.	The development of the endocrine system	Bookmark the red bone marrow. The formation of the epithelial stroma of the thymus. Separation of the thymus parenchyma into the cortical and medulla. The formation of the bodies of Gassal. Spleen. The formation of white and red pulp. The development of lymph nodes.	3	summary
5.	Digestive system development	The pituitary gland is the development of the anterior and middle lobe. The posterior pituitary gland. Differentiation of chromophilic cells.	3	summary
6.	The development of the salivary glands. The development of the stomach and intestines. Bookmark the liver and pancreas.	Bookmark the thyroid and parathyroid glands.	3	summary


## 11. EDUCATIONAL-METHODICAL AND INFORMATION SUPPORT OF DISCIPLINE

### List of recommended literature

#### a) Core reading:

1. Histology, embryology, cytology [Electronic resource]: textbook / Yu. I. Afanasyev, N. A.



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Yurina, E. F. Kotovsky and others; under the editorship of Yu. I. Afanasyev, N.A. Yurina. - 6th ed., Revised. and add. - M.: GEOTAR-Media, 2016. - <http://www.studmedlib.ru/book/ISBN9785970436639.html>

1. 2. Boychuk N.V., Histology, embryology, cytology [Electronic resource]: textbook / N.V. Boychuk, R. R. Islamov, E. G. Ulumbekov, Yu. A. Chelyshev; under the editorship of E. G. Ulumbekova, Yu. A. Chelysheva - M.: GEOTAR-Media, 2016. - 944 p. - Access mode: <http://www.studmedlib.ru/book/ISBN9785970437827.html>

**b) Supplementary reading:**

1. Колесников Л.Л., Terminologia Embryologica. Международные термины по эмбриологии человека с официальным списком русских эквивалентов / Колесников Л.Л., Шевлюк Н.Н., Ерофеева Л.М. - М. : ГЭОТАР-Медиа, 2014. - ISBN 978-5-9704-3080-4 - Текст : электронный // ЭБС "Консультант студента" : [сайт]. - URL : <http://www.studentlibrary.ru/book/ISBN9785970430804.html>
2. Kurnosova, N. A. Training toolkit "Cytology" / N. A. Kurnosova, N. A. Mischeeva ; Ulyanovsk State University, Insitute of Medicine, Ecology and Physical culture. - Ulyanovsk : ULSU, 2016. - 120 с. : ил. - Текст на англ. яз. - Библиогр.: с. 118.

**c) Educational and methodical literature**

1. Guidelines to laboratory work on histology : methodological recommendations for students of the discipline histology, embryology program 060101 "Medical care". P. 1 : Basic tissue types / T. I. Kuznetsova, O. F. Denisova, E. V. Slesareva ; Ulyanovsk State University, Insitute of Medicine, Ecology and Physical culture. - Ulyanovsk : ULSU, 2016. - 14 с.

2. Kuznetsova, T. I.

Guidelines to laboratory work at "Embryonic development of organs and tissues" : methodological recommendations / T. I. Kuznetsova, O. F. Denisova, E. V. Slesareva ; Ulyanovsk State University, Insitute of Medicine, Ecology and Physical culture. - Ulyanovsk : ULSU, 2017. - 12 с

**AGREED:**

*1.1. Библиограф* *О.О.Т. Смаженникова* *1 мая*  
 Position of scientific library employee      full name      signature      date

**b) software**


<b>nomination</b>
СПС Консультант Плюс
НЭБ РФ
ЭБС IPRBooks
АИБС "МегаПро"
ОС MicrosoftWindows
«МойОфис Стандартный»

**d) Professional databases, information and reference systems:**

**1. Electronic library systems:**

1.1. IPRbooks [Electronic resource]: electronic library system / group of companies IPR



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also

- microscopes - 25 pcs student;
- micropreparations according to general histology - 21 sets;
- micropreparations for private histology - 21 sets;
- research microscope -1.

Classrooms equipped with table lighting (2), histological laboratory (building of the medical faculty, 2 arkh. Livchak st.)

The lecture halls are equipped with specialized furniture, a blackboard, and there are also multimedia equipment for working with a large audience.

### 13. SPECIAL CONDITIONS FOR STUDENTS WITH DISABILITIES


If necessary, students from among persons with disabilities (at the request of the student) may be offered one of the following options for perceiving information, taking into account their individual psychophysical characteristics:


for persons with visual impairment: in print in large print; in the form of an electronic document; in the form of an audio file (translation of training materials into audio format); in printed form in braille; individual consultations involving an interpreter; individual tasks and consultations;

for persons with hearing impairment: in print; in the form of an electronic document; video materials with subtitles; individual consultations involving an interpreter; individual tasks and consultations;

for persons with disorders of the musculoskeletal system: in print; in the form of an electronic document; in the form of an audio file; individual tasks and consultations.

If it is necessary to use partly distance educational technologies in the educational process, the organization of work with students with disabilities and disabled people is provided in the electronic information and educational environment, taking into account their individual psychophysical characteristics.

Разработчик  \_\_\_\_\_ зав. кафедрой \_\_\_\_\_ Слесарева Е.В. \_\_\_\_\_  
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