

**MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
VOLODYMYR VYNNYCHENKO CENTRAL UKRAINIAN
STATE UNIVERSITY**

**Faculty of Mathematics, Natural Sciences and Technologies
Department of Natural Sciences and their Teaching Methods**

M. S. Bobrova

**METHODOLOGICAL RECOMMENDATIONS
TO INDEPENDENT WORK ON THE CYTOLOGICAL
BASIS OF HUMAN ONTOGENESIS**

for students of the second (master's) level of higher education in the specialty

014 Secondary education (Chemistry)

subject specialty: 014.06 Secondary education (Chemistry)

combined subject specialty: 014.05 Secondary education (Biology and human health)

educational and professional program: Secondary education

(Chemistry, Biology and human health)

full-time and part-time (distance) forms of education

Kropyvnytskyi 2024

UDC 614(072)

M. S. Bobrova. Methodological recommendations for independent works on the Cytological Basis of Human Ontogenesis. Kropyvnytskyi, Volodymyr Vynnychenko Central Ukrainian State University, 2024. 76 p.

Methodological recommendations are intended for students of the specialty 014.05 Secondary education (Chemistry), subject specialty: 014.06 Secondary education (Chemistry), combined subject specialty: 014.05 Secondary education (Biology and human health), educational and professional program: Secondary education (Chemistry, Biology and human health), full-time and part-time (distance) forms of education include tasks of a reproductive, creative and research nature. Methodological recommendations fully correspond to the work program and include tasks for independent work on the topics: Cytological bases of ontogenesis, Basic laws of embryogenesis, Histological bases of ontogenesis, Ontogenetic features of tissues and organs. Special attention is paid to cytological and histological microphotographs and electronograms.

Reviewers: **I. V. Salnyk**, Doctor of Pedagogical Sciences, Professor, Volodymyr Vynnychenko Central Ukrainian State University.

T.O. Kravtsova, Candidate of Pedagogical Sciences, Associate Professor, Volodymyr Vynnychenko Central Ukrainian State University

Recommended for publication by the Methodological Council of the Volodymyr Vynnychenko Central Ukrainian State University (excerpt from protocol № 4 of May 14, 2024).

INTRODUCTION

Cytological bases of human ontogenesis is the basic discipline of the biological block of the curriculum of specialty 014 "Secondary education (Chemistry)" of the second (master's) level of higher education. The discipline studies the structure and development of the human body at the level of cells, tissues and organs. The knowledge gained during the study of the discipline is required for consistent and purposeful mastering of the morphological foundations of human development, modern issues of cytology, histology and embryology, which is the basis for original thinking on the border of integrated fields of natural science knowledge.

According to the work program "Cytological bases of human ontogenesis", the purpose of teaching the academic discipline is to integrate and deepen students' knowledge of the biology of ontogenesis and phylogeny of organisms through the study of cytological and genetic mechanisms of the development of organisms. The main tasks are: to teach the basic terms, concepts and theoretical positions of modern knowledge of developmental cytogenetics, to form an idea about the diversity of cytological and genetic mechanisms of individual development of eukaryotes and the cytogenetic basis of human ontogenesis, to master certain cytogenetic methods of studying the development of organisms, to consider the relationship between ontogenesis and phylogeny .

The harsh realities of today, associated with the state of war, quarantine regimes and the limitation of direct contact between teachers and students, have led to the search for ways to deliver information to subjects of study and conduct the educational process in the existing conditions. Regardless of the difficulties, students should fully master the subject, gain solid knowledge and learn practical skills.

This manual is intended to activate the independent work of students during practical classes and outside classroom time. The manual is compiled in accordance with the standard curriculum for the educational discipline "Cytological bases of human ontogenesis" for students of higher educational institutions of the III-IV levels of accreditation of the educational and professional program in the specialty 014 "Secondary education (Chemistry)" of the second (master's) level of higher education. The manual is illustrated with electronic diagrams, photomicrographs, drawings and diagrams.

CONTENT

1. ANALYSIS OF PROGRAM REQUIREMENTS FOR INDEPENDENT WORK IN THE DISCIPLINE "CYTOLOGICAL BASES OF HUMAN ONTOGENESIS"	5
2. TASKS FOR INDEPENDENT WORK FOR CONTENT MODULE 1. CYTOLOGICAL BASES OF ONTOGENESIS.....	8
3. TASKS FOR INDEPENDENT WORK FOR CONTENT MODULE 2. BASIC LAWS OF EMBRYOGENESIS	24
4. TASKS FOR INDEPENDENT WORK FOR CONTENT MODULE 3. HISTOLOGICAL BASES OF ONTOGENESIS	36
5. TASKS FOR INDEPENDENT WORK FOR CONTENT MODULE 4. ONTOGENETIC FEATURES OF TISSUES AND ORGANS	50
RECOMMENDED LIST OF SOURCES	72

1. ANALYSIS OF PROGRAM REQUIREMENTS FOR INDEPENDENT WORK IN THE DISCIPLINE "CYTOLOGICAL BASES OF HUMAN ONTOGENESIS"

The discipline "Cytological bases of human ontogenesis" has the following characteristics:

Field of knowledge	01 Education/Pedagogy			
Specialty	014.06 Secondary education (Chemistry)			
Educational and professional program	Secondary education (Chemistry, Biology and human health)			
Level of higher education	the second (master's) level of higher education			
Form of education	full-time			
Course	I			
Semester	I			
Scope of the discipline	Credits	3,5	Hours	105
	Lectures			24
	Practical/seminar			26
	Laboratory			
	Independent work			55
Semester control	Credit			

The aim of studying the discipline: integration and deepening of students' knowledge of the biology of ontogenesis and phylogeny of organisms through the study of cytological and genetic mechanisms of the development of organisms

The task: to teach the basic terms, concepts and theoretical positions of modern knowledge of developmental cytogenetics, to form an idea of the diversity of cytological and genetic mechanisms of individual development of eukaryotes and the cytogenetic basis of human ontogenesis, to master certain cytogenetic methods of studying the development of organisms, to consider the relationship between ontogenesis and phylogeny.

A list of topics with an indication of the number of hours allocated for independent work and other types of work is given in *the structure of the academic discipline*:

Names of sections and topics	Number of hours					
	total	including				
		lk	pr	lab.	per.	independent work of the student
1	2	3	4	5	6	7
Content module 1. Cytological bases of ontogenesis						
Topic 1: Cytogenetic research methods	16	4		4		8
Topic 2: Structure and chemical composition of the cell	11	2		4		5
Topic 3: The main manifestations of vital activity of cells	10	2		2		6
Total by module 1	37	8		10		19
Content module 2. Basic laws of embryogenesis						
Topic 4: Basic laws of embryogenesis	18	4		4		10
Total by module 2	18	4		4		10
Content module 3. Histological bases of ontogenesis						
Topic 5: Epithelial tissue	10	2		2		6
Topic 6: Nervous tissue	8	2		2		4
Topic 7: Connective tissue	8	2		2		4
Topic 8: Postembryonic development	8	2		2		4
Total by module 3	34	8		8		18
Content module 4. Ontogenetic features of tissues and organs						
Topic 9: Ontogenetic features of tissues and organs	8	4		4		8
Total by module 4	16	4		4		8
Total hours	105	24		26		55

Assessment of independent work of students, which is provided for in the topic along with classroom work, is carried out during the current control of the topic in the corresponding classroom lesson. Evaluation of topics that are assigned only to independent work and are not included in the topics of classroom training sessions is controlled by content-based modular control.

The number of points for different types of individual independent work of the student depends on its volume and significance, but no more than 5 points. These points are added to the sum of points scored by the student for the current educational activity, which is reflected in the general scheme of awarding points for the discipline:

Scheme of calculation of points received by students

Current testing and independent work (i/w)									Cyma
Modules									
1			2	3				4	100
T1	T2	T3	T4	T5	T6	T7	T8	T9	
5	5	5	5	5	5	5	5	10	
i/w	i/w	i/w	i/w	i/w	i/w	i/w	i/w	i/w	
5	5	5	5	5	5	5	5	10	

* students' oral or written answers are evaluated on a 5-point scale

Criteria for evaluating students' independent work

Points	Evaluation criteria
5-4	The student fully discloses the questions presented for independent study, freely operates with concepts and scientific terminology, demonstrates deep knowledge of sources, has his own opinion on the relevant topic and is able to prove it with arguments.
4-3	In general, the material for independent work is presented sufficiently fully, but the student makes certain mistakes when completing the tasks assigned for independent study, inaccuracies occur, some questions are incompletely disclosed.
3-2	The student does not fully explain the questions presented for independent study, poorly understands their essence, tries to draw conclusions, but at the same time makes gross mistakes, presents the material illogically, inconsistently.
2-1	The completed work looks hastily done or unfinished. There are significant factual errors, ambiguities, misunderstanding of the topic or inconsistency of the presented material with the intended topic for independent study.

2. TASKS FOR INDEPENDENT WORK FOR CONTENT MODULE 1. CYTOLOGICAL BASES OF ONTOGENESIS

TOPIC «INTRODUCTION TO THE CYTOLOGICAL BASES OF ONTOGENESIS»

- 1. What level of organization of living matter exploring the smallest structural and functional unit of life?**
 - a) organismal level b) cellular level c) biosphere level d) molecular level
- 2. What is the science about human development?**
 - a) Cytology b) General histology c) Special histology d) Embryology
- 3. What period of development of histology is famous for works of Aristotle (IV century BC), Galen (III century BC), and Avicenna (tenth century BC) Visalij and Fallopij (16th century ad) there is evidence of anatomical splitting of the body into homogeneous parts?**
 - a) Electron-microscopic period c) before microscopic period,
 - b) microscopic period d) modern microscopic period
- 4. Who described the structure of the skin, kidney, spleen, blood?**
 - a) Theodor Schwann and Mathias Shlayden b) R. Brown
 - b) M. Malpighi, N. Gru, A. Leeuwenhoek d) K. Ber
- 5. Who produced the first commercial transmission electron microscope?**
 - a) Kolliker b) Golgi c) Siemens d) Brown
- 6. What type of microscopy exploring living cells in the light that is emitted by the microscope slide?**
 - a) Fluorescence microscopy c) Ultraviolet – microscopy
 - b) Transmission electron microscopy d) Phase-contrast microscopy
- 7. What type of microscopy has that features: large resolution, the possibility of quantitative analysis, working with unpainted microscope slide?**
 - a) Fluorescence microscopy c) Ultraviolet – microscopy
 - b) Transmission electron microscopy d) Phase-contrast microscopy
- 8. What type of microscopy instead of light uses a beam of electrons, which is obtained from the cathode of the lamp?**
 - a) Fluorescence microscopy c) Ultraviolet – microscopy
 - b) Transmission electron microscopy d) Phase-contrast microscopy
- 9. What type of microscopy is based on differences of refractive indices of individual sections of the transparent object and the environment?**
 - a) Fluorescence microscopy b) Ultraviolet – microscopy
 - c) Transmission electron microscopy d) Phase-contrast microscopy

- 10. What is the process of luminescence in the emission energy, if it ceases immediately after termination of the excitation?**
 a) Phosphorescence b) Fluorescence c) Luminescence
- 11. What level of organization of living matter exploring life in all our planet?**
 b) organismal level b) cellular level c) biosphere level d) molecular level
- 12. What is the science about human development?**
 b) Embryology b) General histology c) Special histology d) Cytology
- 13. What period of development of histology is famous for scanning electron microscopic?** a) Electron-microscopic period b) before microscopic period,
 c) microscopic period d) modern microscopic period
- 14. Who described the nucleus of cell?**
 a) Theodor Schwan and Mathias Shlayden c) R. Broun
 b) M. Malpighi, N. Gru, A. Leeuwenhoek d) K. Ber
- 15. Who constructed the first microscope?**
 b) Kolliker b) Guk c) Siemens d) Brown
- 16. What type of microscopy exploring living cells in the light that is emitted by the microscope slide?**
 c) Phase-contrast microscopy c) Ultraviolet – microscopy
 d) Transmission electron microscopy d) Fluorescence microscopy
- 17. What type of microscopy is based on the principle of light scattering at the interface of phases with different refractive indices. Beams of light on the object do not fall and get only the extreme rays of the beam in the field of view is dark and the object is illuminated by the extreme rays of light?**
 c) Dark-fild microscopy c) Ultraviolet – microscopy
 d) Transmission electron microscopy d) Phase-contrast microscopy
- 18. What type of microscopy instead of light uses a beam of electrons, which is obtained from the cathode of the lamp and explores the surface of the cell?**
 a) Fluorescence microscopy c) Scanning electron microscopy
 b) Transmission electron microscopy d) Phase-contrast microscopy
- 19. What type of microscopy is based on differences of refractive indices of individual sections of the transparent object and the environment?**
 a) Fluorescence microscopy b) Phase-contrast microscopy
 c) Transmission electron microscopy d) Ultraviolet – microscopy
- 20. What is the process of luminescence in the emission energy, if it ceases immediately after termination of the excitation?**
 b) Phosphorescence b) Fluorescence c) Luminescence

TOPIC: «METHODS OF PREPARATION OF THE MICROSCOPE SLIDE»

INFORMATION

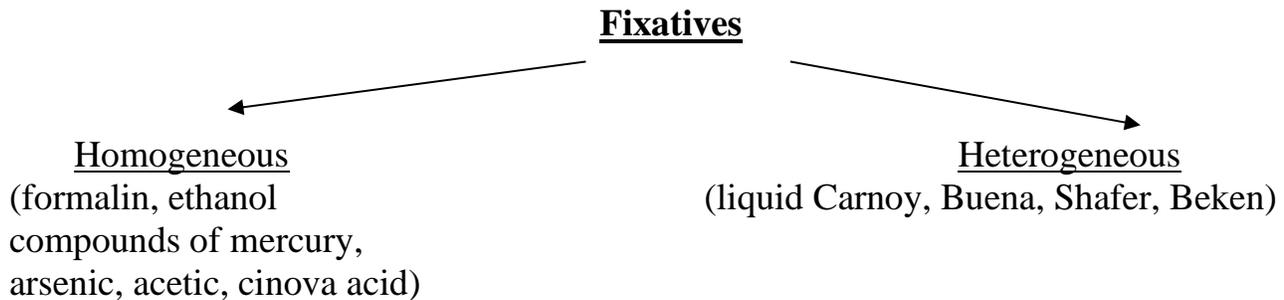
Total circuit training microbert: *selection – fixation – washing – dehydration – seal – conclusion in paraffin – microtomyan – coloring – mount.*

The principles of selection of the object of study:

1. A clear definition of the objectives of the study (as for the study of mitosis using meristematic plant tissue, epithelium animals, and for the study of meiosis and counting the number of chromosomes, the cells of the microspores of plants of the Legume family, double fertilization and embryogenesis – cell dusty flowers, phagocytosis – amoebas plasmas – skin onion scales).
2. Compliance with the relevant environmental conditions favorable for observations of the research process (temperature, humidity, illumination, time of day, etc.)
3. Achieve the object of the desired physiological state.

The essence and methods of fixation of micro-objects.

Fixation, a quick cessation of life processes in the cell, stabilization of the investigated structures by treatment with special chemicals (fixers). All fixatives are poisonous substances that cause irreversible changes: denaturation of proteins, precipitation of colloids of cytoplasm, so the image cell structures may be somewhat distorted.



To remove the rest of the clips object is washed, put in gauze bags, tie coarse thread, placed in a glass funnel filled with water and rinsed 1-3 hours running water. If the lock pin is contained ethyl alcohol, may be washed with alcohol.

Methods of compaction and dewatering is carried out by successive immersion of the object in solutions of alcohols of increasing concentration (from 60 to 100 %).

Manufacture of paraffin blocks. For ultrathin sections the object is tentatively conclude in paraffin. Use paraffin with a melting point of 52-54 °C, it is filtered from mechanical impurities left in the molten state in a thermostat for several days to remove volatile impurities. After compaction, the object is first placed in from intermediate solvent

(xylene, benzene, toluene, chloroform) which is mixed with alcohol and paraffin. Next, in a glass object, filled with the intermediate solvent is poured into the molten paraffin and left in the thermostat (under the hood) for a few days for the evaporation of the intermediate solvent. Then, the object, together with the wax poured into a special paper boxes – cooled, remove the cardboard, get the so-called "wax cakes", which are made of paraffin blocks that are fixed on special wooden holders set in the holder of microtome and make slices of a given thickness.

The production of slices. Sectioning

Microtome – a device for the manufacture of histological sections. Sometimes these types:

- calatone (moving knife)
- rotary than fixed, the object rotates around the knife) allow you to make sections with a thickness of 2-10 μm ,
- ultrascreen (slices with thickness of 1 μm or less, has a glass knife, United with stereomicroscopes)
- microtome, which freezes (the object is placed on a table in a drop of water, feeding H_2CO_3 cool table, or knives)
- cryostat – microtome, placed in the freezer, allows you to make cuts without prior fixation. Used to study the activity of enzymes, localization of organic compounds.

Ready slices glued to a glass slide with a mixture of egg white with glycerin, serum, or distilled water (the gluing is carried out by a capillary attraction). For the removal of paraffin from slices them through xylene or toluene. Then the slides sequentially immersed in solutions of ethyl alcohol, the concentration of which decreases, washed in water (if necessary) and colored.

The nature and methods of painting the microscope slide.

Classification of dyes:

- ***acid*** (cytoplasmic) acid and their salts; have known, nitro-, hydro -, or a carboxyl group (pcinema acid, eosin, fuchsin, azocarmine, Congo red, hematoxylin, neutralist and the like). Structure that turns acidic dyes – oxyphilic, or acidophilus: components of the cytoplasm, cell walls, etc.;
- ***alkaline*** (nuclear) – compounds containing amino-, MD - and hydroxyl group (Isobaric, samanni, azure C, A, b, methylene blue and green and so on). Structure, coated basic dyes – basophilic: nuclear structure
- ***neutral*** – formed after the connection of aqueous solutions of acidic and basic dye (Sudan III, Sudan IV, Nile blue). Used for selective staining of cytoplasmic components (e.g., fatty inclusions)
- ***fluorochrome*** – specific dyes capable of fluorescence (Nile red, acridine orange).

Methods of dyeing:

- **progressive** (microbert placed in a weak solution of the dye for a few minutes);
- **regressive** (microbert is applied to a concentrated solution of the dye, which can leave only on certain structures of the cell, controlling the process under a microscope – differentiation micropreparations).

The impregnation method (spraying) is the precipitation on certain structures of particles recovered silver, gold or platinum from their salts. Used most often in the study of nervous tissue and cell contacts.

Mounting micropreparations. The stained sections are washed in water and immersed sequentially in ethanol, xylene and conclude in balsam canadian, immediately cover with a cover glass (at an angle), the side of which lay the pieces of filter paper for removal of excess of xylol and balsam.

Canadian balsam – a special resin of coniferous tree, which is well soluble in xylene, toluene, benzene. Advantages: retains micropreparations, clear cuts, dries quickly, is absolutely transparent and has a refraction index close to the refractive index of the glass.

Micropreparations dried for several days (sometimes under pressure to remove bubbles). After drying microsoft and mark: left – number, right – the name.

For rapid production of permanent microscope slide. objects enclosed in glaringly. Allows not to paint microbert not pass through alcohols.

Advantage – ease and speed of preparation. The disadvantage is the reduced shelf life, discoloration of the colored products.

QUESTIONS TO THE TOPIC:

1. What is the sequence of steps in the manufacture of a microscope slide?
2. What are the 3 main principles in the choice of object of study?
3. Why the need for the fixatives?
4. How named the fixatives, which consists of only one component?
5. How named the fixatives, which consists of several components?
6. With what substances carry out dehydration of the object of study?
7. What is the "wax cakes"?
8. Why do we use intermediate solvent when we manufacturing of paraffin blocks
9. How is a device for making slices?
10. What types of microtomes do you know?
11. About what type of dye is it?
 - a) It consist of acid and their salts; have known, nitro-, hydro -, or a carboxyl group (pcinema acid, eosin, fuchsin, azocarmine, Congo red, hematoxylin,

neutralist and the like). Structure that turns acidic dyes – oxyphilic, or acidophilus: components of the cytoplasm, cell walls, etc.;

- b) compounds containing amino-, MD - and hydroxyl group (Isobaric, samanni, azure C, A, b, methylene blue and green and so on). Structure, coated basic dyes – basophilic: nuclear structure
- c) it formed after the connection of aqueous solutions of acidic and basic dye (Sudan III, Sudan IV, Nile blue). Used for selective staining of cytoplasmic components (e.g., fatty inclusions)

12. What methods of dyeing do you know?

13. What is the canadian balsam?

14. How mark microscope slide?

TOPIC: «METHODS OF RESEARCH IN THE CYTOLOGICAL BASES OF ONTOGENESIS»

1. The mechanical part of the microscope include:

- A) Eyepiece (ocular lens) B) Screw C) Condenser D) Objective lens

2. Condenser with iris is a lens system which:

- A) Serves for collecting the light rays which converge into a beam
- B) Increases the image of the object
- C) Scatters the rays of light

3. If the eyepiece magnifies 10 times and the lens 20 times, the total magnification of the microscope is: A) 30 times B) 150 times C) 200 times D) 300 times

4. Through which the light travels from the bulb of the microscope, before getting into the human eye:

- A) the hole in the object table – background on the object – the eyepiece lens
- B) the hole in the object table – background on the object – lens eyepiece
- C) the object of study – the hole in the object table, the eyepiece lens
- D) the object of study – the hole in the object table lens – eyepiece

5. When working with the microscope one looks at:

- A) the eyepiece (ocular lens), and the objective lens focused on the object of study
- B) the eyepiece (ocular lens), and the objective lens focused on the object table
- C) the objective lens, and the eyepiece (ocular lens) is aimed at the object under study
- D) the objective lens, and the eyepiece (ocular lens) is aimed at the object table

6. Which of the following substances are used as fixers:

- A) Formalin B) Distilled water C) Physiological saline

7. For cutting on the microtome objects are soaked by:

- A) Glycerin B) Paraffin C) Clay

8. Oxyphilic are called structures, which are colored by dyes:

- A) Special B) Alkaline C) Acid

9. What is the purpose of the research objects sequentially immersed in alcohols of increasing concentration:

- A) Dehydration B) Splitting C) Mitigation

10. Set the correspondence between the cytological method of research and its definition:

- | | |
|--------------------|---|
| A) Cytochemical | 1. Based on the layered sedimentation of different mass and density of the structural components of the cell under the action of centrifugal acceleration |
| B) Autoradiography | 2. Research products and processes of vital activity of the cells placed in an artificial nutrient medium |
| C) Centrifugation | 3. The introduction of radioactive labels (radionuclide, isotopes) substance with the subsequent their inclusion in the metabolism |
| D) Cell culture | 4. Qualitative and quantitative determination of chemical components of cells and their localization |

11. If the eyepiece magnifies 20 times and the lens 40 times, the total magnification of the microscope is: A) 60 times B) 120 times C) 200 times D) 800 times

12. Which of the following substances are used as fixers:

- A) Ethanol B) Distilled water C) Physiological saline

13. Basophilic are called structures, which are colored by dyes:

- A) Special B) Alkaline C) Acid

14. What is the purpose of the research objects sequentially immersed in alcohols of increasing concentration:

- A) Mitigation B) Splitting C) Dehydration

15. It is an adjustable light barrier built into the condenser that regulates the amount of light passing through the specimen:

- A) Screw B) Diaphragm C) Body Tube D) Stage

16. Through which the light travels from the bulb of the microscope, before getting into the human eye:

- A) the object of study – the hole in the object table, the eyepiece lens
 B) the object of study – the hole in the object table lens – eyepiece
 C) the hole in the object table – background on the object – the eyepiece lens
 D) the hole in the object table – background on the object – lens eyepiece

17. When working with the microscope one looks at:

- A) the eyepiece (ocular lens), and the objective lens focused on the object of study
 B) the eyepiece (ocular lens), and the objective lens focused on the object table
 C) the objective lens, and the eyepiece (ocular lens) is aimed at the object under study

D) the objective lens, and the eyepiece (ocular lens) is aimed at the object table

18. The optical part of the microscope include:

A) Stage B) Screw C) Condenser D) Body Tube

19. For cutting on the microtome objects are soaked by:

A) Glycerin B) Clay C) Paraffin

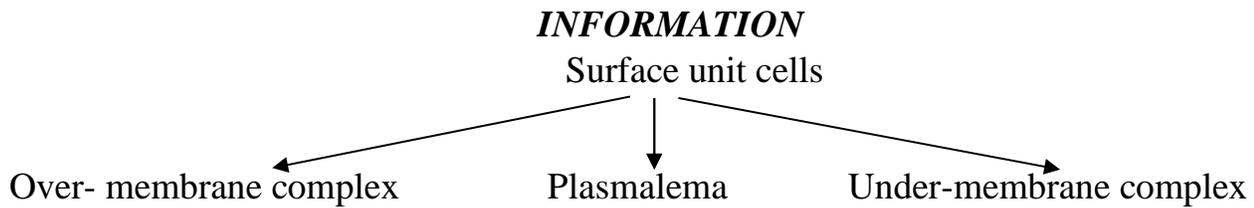
20. Set the correspondence between the cytological method of research and its definition:

- | | |
|--------------------|---|
| A) Cytochemical | 1. Based on the layered sedimentation of different mass and density of the structural components of the cell under the action of centrifugal acceleration |
| B) Autoradiography | 2. Qualitative and quantitative determination of chemical components of cells and their localization |
| C) Centrifugation | 3. Research products and processes of vital activity of the cells placed in an artificial nutrient medium |
| D) Cell culture | 4. The introduction of radioactive labels (radionuclide, isotopes) substance with the subsequent their inclusion in the metabolism |

21. Find the correspondence between the name parts of the microscope and its description

1	Condenser	A.	The illuminator for your microscope is built into the base and is controlled by an on/off switch.
2	Ocular lenses	B.	are the lenses you look through.
3	Diaphragm	C.	contains a series of lenses that focus light onto the specimen
4	Stage	D.	it is an adjustable light barrier built into the condenser that regulates the amount of light passing through the specimen
5	Arm	E.	The part of the microscope that rests on the table is called the base.
6	Body Tube	F.	it is a vertical support that connects the base of the microscope to the body tube.
7	Base	G.	The part of the microscope that connects the oculars with the revolving nosepiece.
8	Focus Knobs (Screw)	H.	The surface on which you place your slide is called the stage.
9	Light Source	I.	You can focus your microscope by using the coarse and fine adjustment knobs located on the sides of the arm.

TOPIC: «CYTOLEMMMA. SURFACE UNIT CELLS»



Biological membrane as the basis of the structure of the cell.

THE STRUCTURE OF MEMBRANE (the model of Senger-Nicholson, 1972):

1. Bi-layer of lipids (80% phospholipids):

○ ← glycerol head (hydrophilic, soluble in water)

^ ← the tails of fatty acids (hydrophobic, insoluble in water)

In general, the protein molecule is ample

2. Proteins (surface, cross-cutting, half-sunk);

3. Carbohydrates:

Glucose = carbohydrate + lipid

Glycoprotein = carbohydrate + protein

4. Liquid-mosaic structure (20% of lipids with the protein fixed, all others can "swim freely" performing a protective function in case of damage)

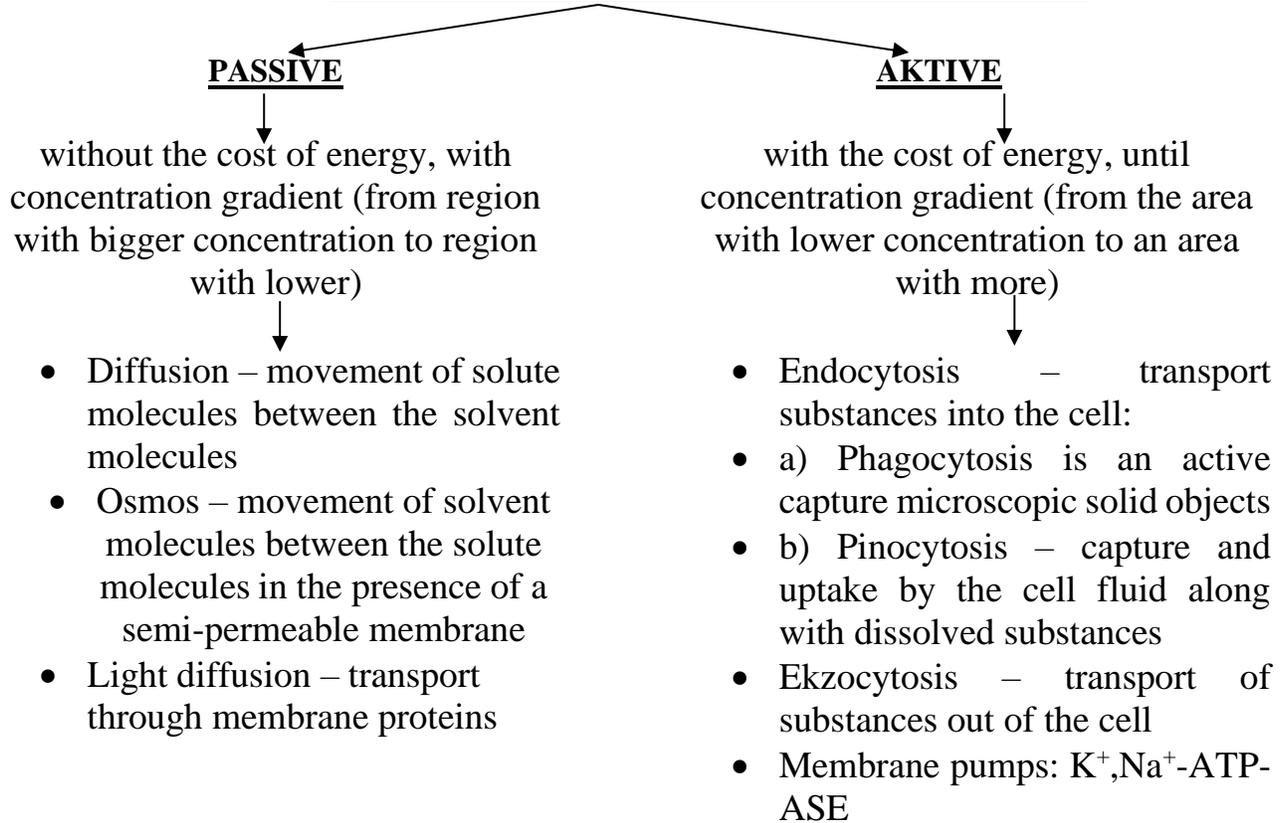
Lipids, which are part of the membrane double layer, is not fixed rigidly and constantly changing places. The movement of lipid molecules is of two types: 1) within one monolayer (lateral diffusion) and 2) by inverting the two lipid molecules which are opposed to each other in two different layers ("flip-flop")

Properties of the MEMBRANES: the ability to pass some substances, strenuous other hydrophobic molecules are transported through the white bilipid layer, hydrophilic – through-proteins)

FUNCTIONS OF MEMBRANES:

1. Barrier
2. Transport
3. Homeostatic
4. Signal, receptor
5. Protective (complex "antigen-antibody")
7. Intercellular contacts

Transport of substances through the membrane



Over- membrane complex

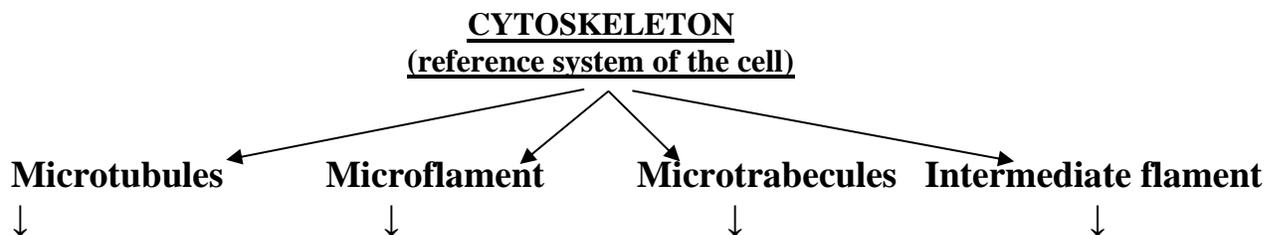
In animals over- membrane complex representative by layer of glicocalix (glicolipids + glyoprotein).

Glicocalix performs the following functions:

1. treats the irritation,
2. communicates between cells
3. provides extracellular digestion

Under membrane complex

In animals under-membrane complex representative *by* **CYTOSKELET**



Hollow protein cylinders (d = 25 nm, a wall thickness of 4 nm) made from protein tubuline.	Thin protein strands, (d = 5 - 7 nm) built from the protein actin and much less myosin	Thin fibrils (2-3 nm), crossing the cytoplasm in various directions. At points of intersection located in the ribosome.	Thin protein cords (d = 8-10 nm)
<i>Functions: a support; a component of centrioles, flagella, cilia; form the threads of the spindle, carry out intracellular transport of organelles</i>	<i>Functions: support; provides motor activity of the cytoplasm, are involved in endocytosis, in the formation of constrictions during cell division, and providing movement</i>	<i>Functions: bind organelles, plasmallem and micro tubes.</i>	<i>Functions: structural – anti-stretch</i>

THE MAIN MANIFESTATIONS OF CELL ACTIVITY includes:

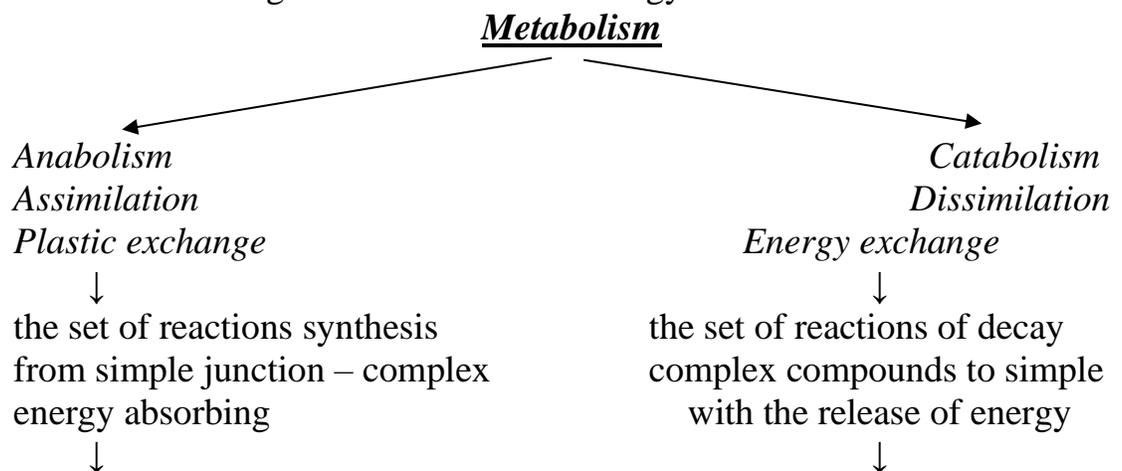
1. Cell differentiation
2. Metabolism
3. The aging of cells
4. Cell death: apoptosis and necrosis
5. Cell division

1. Cell differentiation – the emergence of differences in the structure and functions of cells, tissues and organs during ontogeny. Differentiation provides the distribution of functions (specialization) between cells to ensure unity in functioning of the organism as a whole.

Potentially every cell contains in its genome the complete information about the development of the whole organism and under certain conditions can give rise to the formation of certain organs or the whole organism (totipotency).

The processes of differentiation are based on gene activity regulation. Therefore, any differentiated cell are simultaneously "on" have different genes and their combination that determines the synthesis of specific proteins and perform different functions.

2. Metabolism - exchange of substances and energy in the cell



biosynthesis protein,
photosynthesis,
reduplicate
transcription

the formation of ATP in the
mitochondria in the breakdown
of carbohydrates

Theories of aging cells (figure 1):

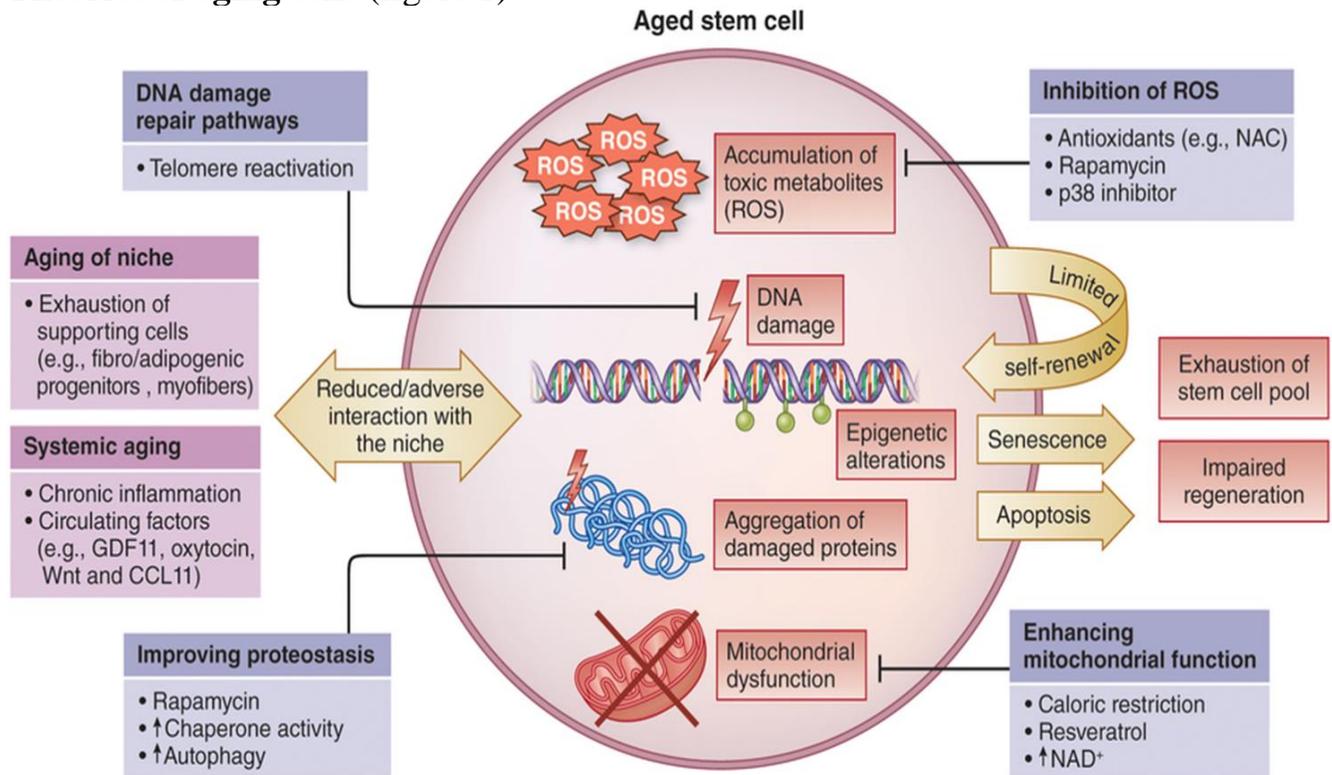


Figure 1. Theories of aging cells

Apoptosis and necrosis (figure 2)

Apoptosis (from gr. *ἀπόπτωσης* — falling) is the most common type of programmed cell death. In other words it is a collection of cellular processes leading to cell death. The process of apoptosis is required for physiological regulation of the number of cells of the body, for the destruction of old cells to form lymphocytes are not reactive to their antigens (autoantigens), for the autumn leaf fall of plants, for the cytotoxic action of T-lymphocytes killer cells, for embryonic development of the organism (the disappearance of the cutaneous webs between the fingers in the embryo of birds) and more. Disruption of normal apoptosis leads to uncontrolled proliferation of cells and the appearance of the tumor.

Necrosis (from the greek. *Νεκρός* — death) is the pathological condition in which there is denaturation of intracellular proteins and fermentation the digestion of dead cells.

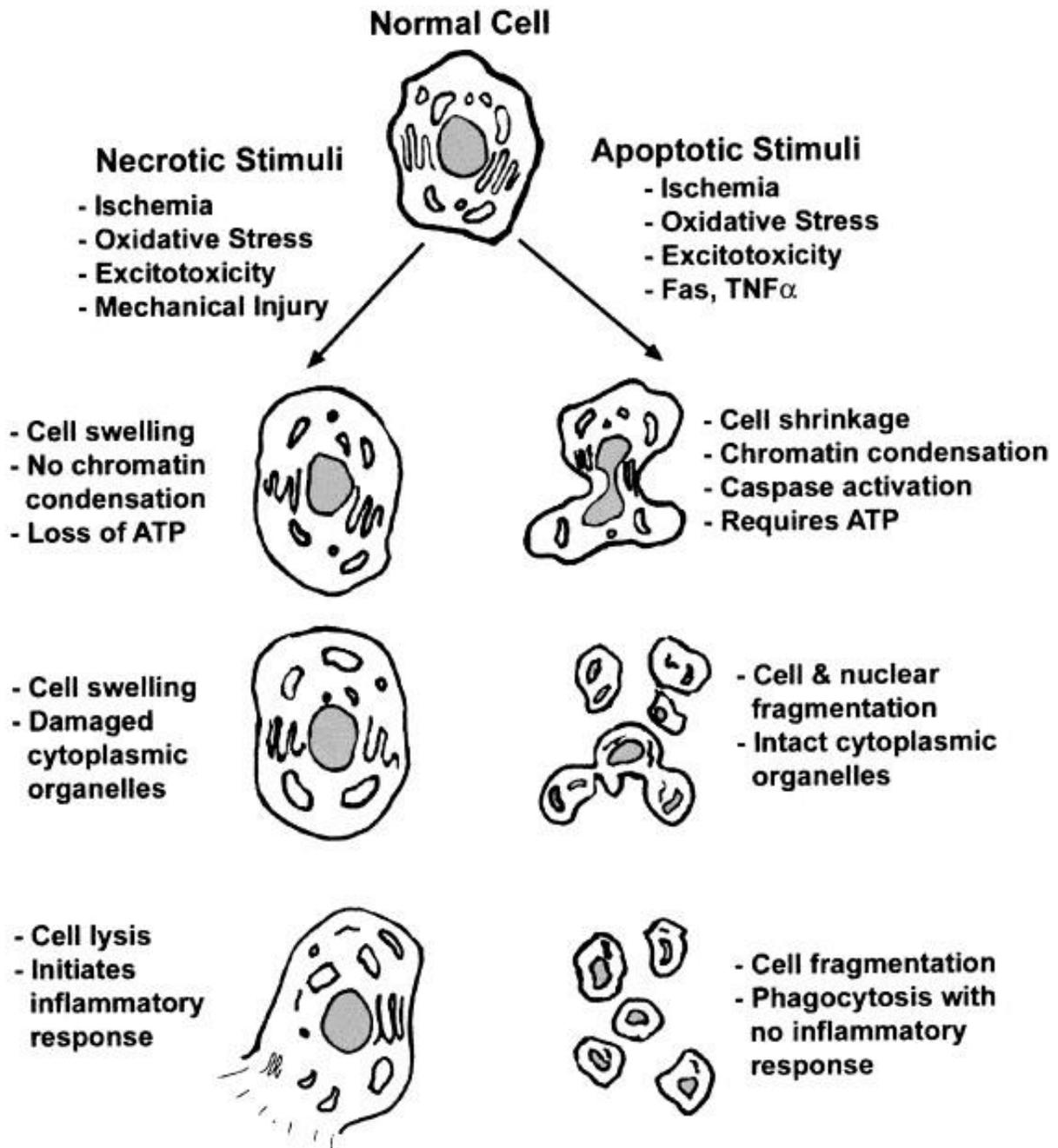


Figure 2. Comparison of apoptosis and necrosis

QUESTIONS TO THE TOPIC:

1. What are the 3 main components of the surface unit cell.
2. What are the 3 main components of membranes?
3. Why is the membrane called «liquid-mosaic»?
4. What are the main functions of the membrane?

5. What types of transport through the membrane do you know? What is the difference between them?
6. What is over- membrane complex?
7. What is under- membrane complex?
8. What are the main components of the cytoskeleton? What is the difference between them?
9. What are the main manifestations of cellular activity do you know?
10. What is the nature and causes differentiation of cells?
11. What is the difference between anabolism and catabolism? Give the example?
12. What are the main causes of aging?
13. What are 2 main ways of cell death do you know?

TOPIC: «NUCLEUS. KARYOTYPE. INCLUSION»

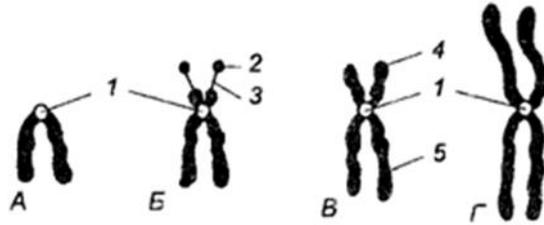
1. Structural components of interphase nucleus:
 - a) the karyolemma, karyoplasma, chromatin and nucleoli;
 - b) chromatin and thylakoid;
 - c) karyolympha and grains, the nucleoli;
 - d) stroma, karyolemma and chromatin.
2. Features shell core (karyolemma):
 - a) two membrane without ribosomes and pores;
 - b) one membrane with ribosomes on the inner surface of the connected with EPR channels;
 - c) two membrane with ribosomes and perinuclear space;
 - d) one elementary membrane with ribosomes on the outer surface and pores;
3. Function of nucleolus:
 - a) interconnect with curiosity cytoplasm;
 - b) synthesize of chromatin;
 - c) synthesize DNA;
 - d) synthesize r-RNA and provides assembly of subunits of ribosomes.
4. Function of nucleos:
 - a) protein synthesis;
 - b) storage, transfer and realization of genetic information;
 - c) synthesis of polysaccharides;
 - d) phagocytosis.
5. Structural components of metaphase chromosomes:
 - a) two chromatids, centriole and satellite.
 - b) one chromatid, centromere and telomeres.
 - c) centromere two chromatids and telomeres;
 - d) centriole, the satellite and secondary constriction;
6. Karyotype is:
 - a) a haploid set of chromosomes;

- b) set of chromosomes somatic cells;
- c) set of chromosomes sex cell;
- d) the set of genes in a diploid set of chromosomes.

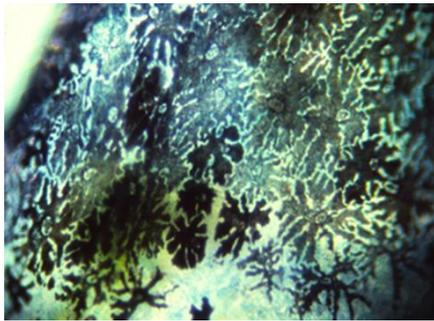
7. Specify the number of autosomes in the karyotype of a person: a) 46 b) 44 c) 2
d) 23

8. Specify the number of heterosomes in the human karyotype: a) 46 b) 44 c) 2
d) 23

9. Metacentric chromosome shown in figure:

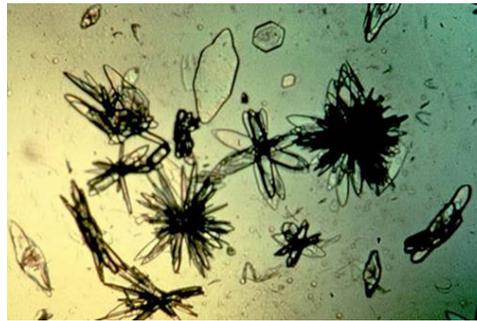


10. Find correspondence between image and type of cell inclusion:



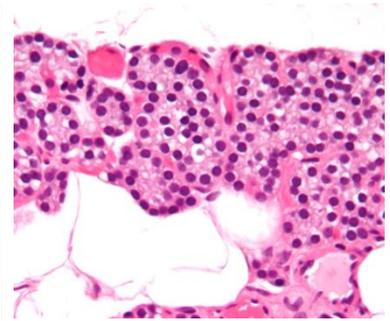
1

A) excretory



2

B) pigmentary



3

C) secretory

RECOMMENDED LIST OF SOURCES:

1. Цитологія (атлас для самостійної роботи студентів): навч. посіб. / Н. Б. Гринцова, Л. І. Кіптенко, М. М. Дунаєва та ін.; за заг. ред. В. І. Бумейстер. Суми : СумДУ, 2020. 65 с.
2. Цитологія: Підручник. Трускавецький Є.С. К.: Вища школа, 2004. 254 с.
3. Цитологія і загальна ембріологія. Навчальний посібник. Під ред. Е.Ф. Барінова, Ю.Б. Чайковського. Київ, ВСВ «Медицина», 2010. 216 с.
4. Яременко Л.М., Божко О.Г., Грабовий О.М., Чайковський Ю.Б. Компедіум з цитології, загальної ембріології та гістології. Київ: Книга-плюс. 2020. 144 с.
5. Kierszenbaum A.L., Tres L.L. Histology and Cell Biology. Elsevier, Philadelphia, 2012. 701 p.
6. Kühnel W. Color Atlas of Cytology, Histology, and Microscopic Anatomy, 4th edition. Stuttgart: Georg Thieme Verlag; 2003. 534 p.

7. Leslie P. Gartner, James L. Hiatt. Color atlas and text of histology, Sixth Edition, 2014. 525 p.
8. Melnyk, N.O. Histology, cytology and embryology. K.: Book-plus, 2017. 416 p.

INTERNET SOURCES:

1. <https://uk.wikipedia.org/wiki/%D0%9C%D1%96%D1%82%D0%BE%D1%85%D0%BE%D0%BD%D0%B4%D1%80%D1%96%D1%8F>
2. <https://www.google.com/url?sa=i&url=https%3A%2F%2Fvseosvita.ua%2Ftest%2Flaboratorne-doslidzhennia-2-fazy-mitozu-1793811.html&psig=AOvVaw1u7YbDmDXytgLD1ENEY25W&ust=1677307861093000&source=images&cd=vfe&ved=2ahUKEwjO0JfryK39AhWIPOwKHTPQAbYQr4kDegUIARC6AQ>
3. <https://www.google.com/url?sa=i&url=https%3A%2F%2Fuk.wikipedia.org%2Fwiki%2F%25D0%259C%25D1%2596%25D1%2582%25D0%25BE%25D0%25B7&psig=AOvVaw0RfUHx9WHhi16fZIdWbiLE&ust=1677310730176000&source=images&cd=vfe&ved=0CBAQjRxxqFwoTCNiHy8PTrf0CFQAAAAAdAAAAABAF>
4. https://www.google.com/url?sa=i&url=https%3A%2F%2Fstudref.com%2F437054%2Fagropromyshlennost%2Fzaschitnye_mehanizmy_organizma&psig=AOvVaw1CUNMiInk6bTHMaq8rJUlq&ust=1677309697120000&source=images&cd=vfe&ved=0CBEQjhxqFwoTCNip_tbPrf0CFQAAAAAdAAAAABAJ
5. <http://ibib.ltd.ua/znachennya-hromosomnoyi-organizatsiyi-u-funktsionuvanni-ta-spadkuvanni-genetichnogo.html>
6. https://zno.osvita.ua/biology/tag-zberezhenja_spadkovoyi_informaciyi/
7. https://www.google.com/url?sa=i&url=http%3A%2F%2Fwww.irbis-nbuv.gov.ua%2Fcgi-bin%2Firbis_nbuv%2Fcgiirbis_64.exe%3FC21COM%3D2%26I21DBN%3DUJRN%26P21DBN%3DUJRN%26IMAGE_FILE_DOWNLOAD%3D1%26Image_file_name%3DPDF%2FS_med_2013_4%252842%2529_35.pdf&psig=AOvVaw2diVEqkoo3jwB3d11D31Gc&ust=1677307154428000&source=images&cd=vfe&ved=2ahUKEwivopyaxq39AhVpxQIHHUItD10Qr4kDegQIARBP
8. https://www.google.com/url?sa=i&url=https%3A%2F%2Fmozok.click%2F1318-citoplazma-y-osnovn-kltinn-organeli.html&psig=AOvVaw0O-rc4mJJ_k6EBtQgcudd3&ust=1677304900962000&source=images&cd=vfe&ved=2ahUKEwix9fnva39AhWLYaQKHeLjDiQQr4kDegUIARDFAQ

3. TASKS FOR INDEPENDENT WORK FOR CONTENT MODULE 2.

BASIC LAWS OF EMBRYOGENESIS

1. Look carefully at the *figure 3*, find and label cells that are in each stage of mitosis

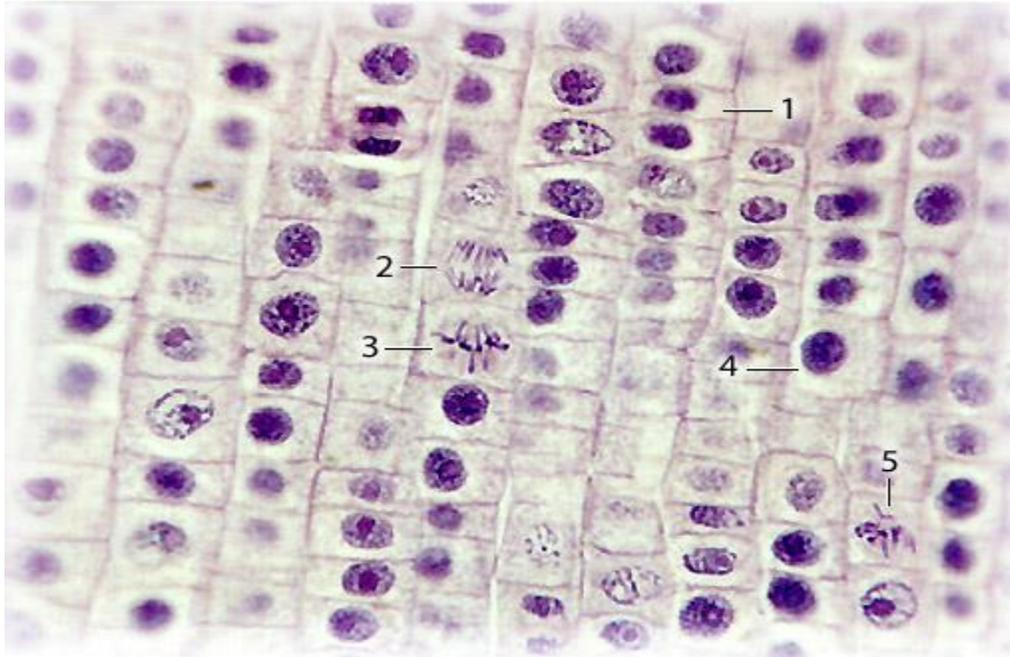


Figure 3. Plant cells in different stage of mitosis

2. Imagine that you are a geneticist and examine the karyotype. It is known that in the cells of the dog's 78 chromosomes. Specify the number of chromosomes and chromatids in each stage of mitosis and meiosis. Write the result in the table:

Phase of cell division	Type of cell division				Phase of cell division
	mitosis		meiosis		
	N chromosomes	N chromatids	N chromosomes	N chromatids	
Prophase					Prophase I
Metaphase					Metaphase I
Anaphase					Anaphase I
Telophase					Telophase I
					Prophase II
					Metaphase II
					Anaphase II
					Telophase II

3. Look carefully at the *figure 4*, find and label cells that are in each stage of mitosis

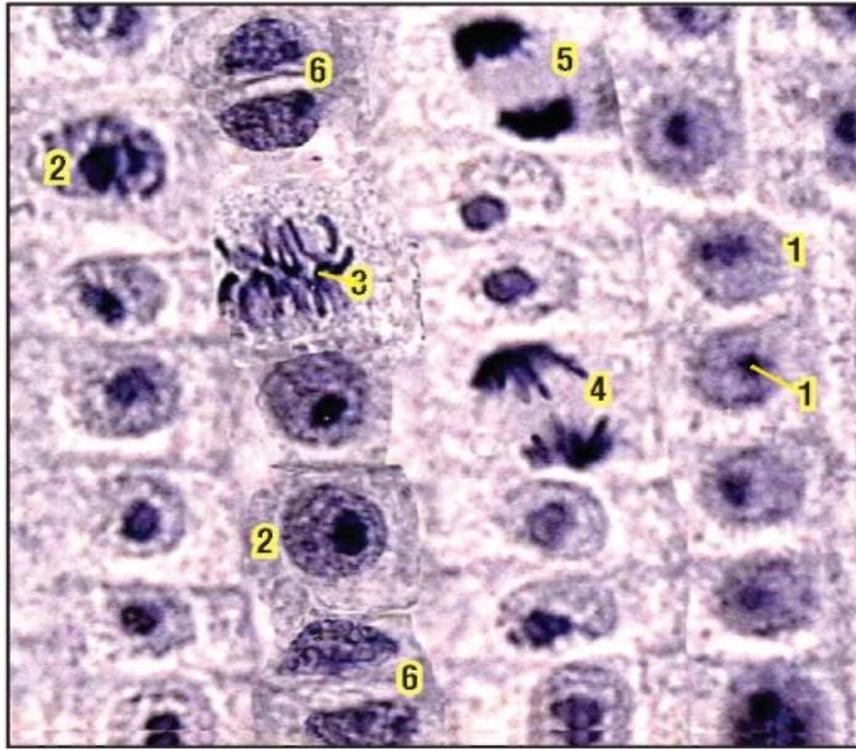


Figure 4. Plant cells in different stage of mitosis

4. Imagine that you are a geneticist and examine the karyotype. It is known that in the cells of the monkey's 48 chromosomes. Specify the number of chromosomes and chromatids in each stage of mitosis and meiosis. Write the result in the table:

Phase of cell division	Type of cell division				Phase of cell division
	mitosis		meiosis		
	N chromosomes	N chromatids	N chromosomes	N chromatids	
Prophase					Prophase I
Metaphase					Metaphase I
Anaphase					Anaphase I
Telophase					Telophase I
					Prophase II
					Metaphase II
					Anaphase II
					Telophase II

5. Look carefully at the *figure 5*, find and label cells that are in each stage of mitosis

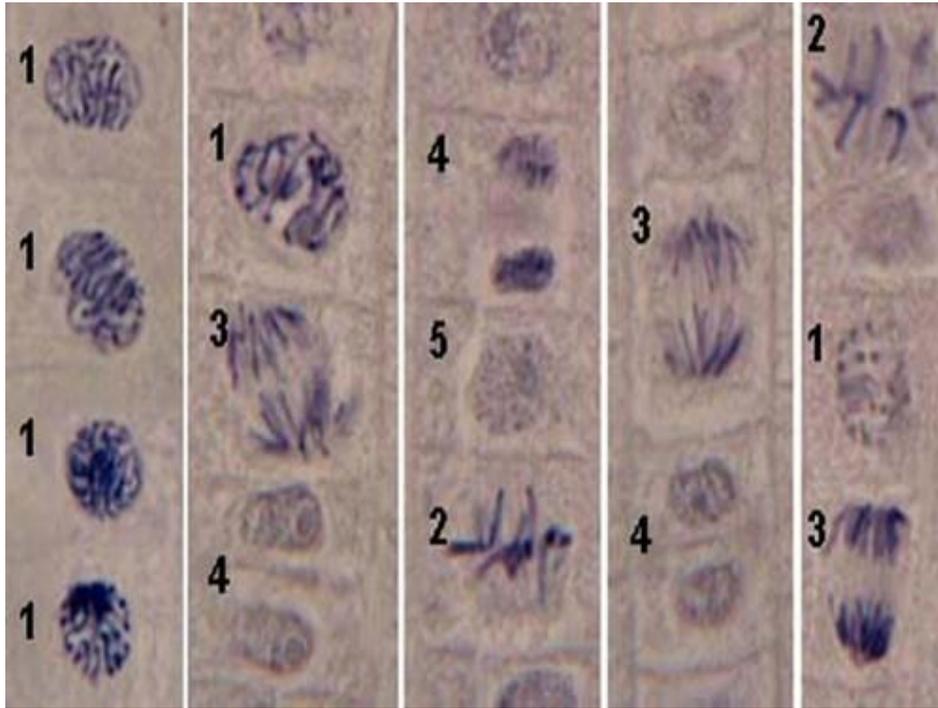


Figure 5. Plant cells in different stage of mitosis

6. Imagine that you are a geneticist and examine the karyotype. It is known that in the cells of the rabbit's 44 chromosomes. Specify the number of chromosomes and chromatids in each stage of mitosis and meiosis. Write the result in the table:

Phase of cell division	Type of cell division				Phase of cell division
	mitosis		meiosis		
	N chromosomes	N chromatids	N chromosomes	N chromatids	
Prophase					Prophase I
Metaphase					Metaphase I
Anaphase					Anaphase I
Telophase					Telophase I
					Prophase II
					Metaphase II
					Anaphase II
					Telophase II

7. Look carefully at the *figure 6*, find and label cells that are in each stage of mitosis

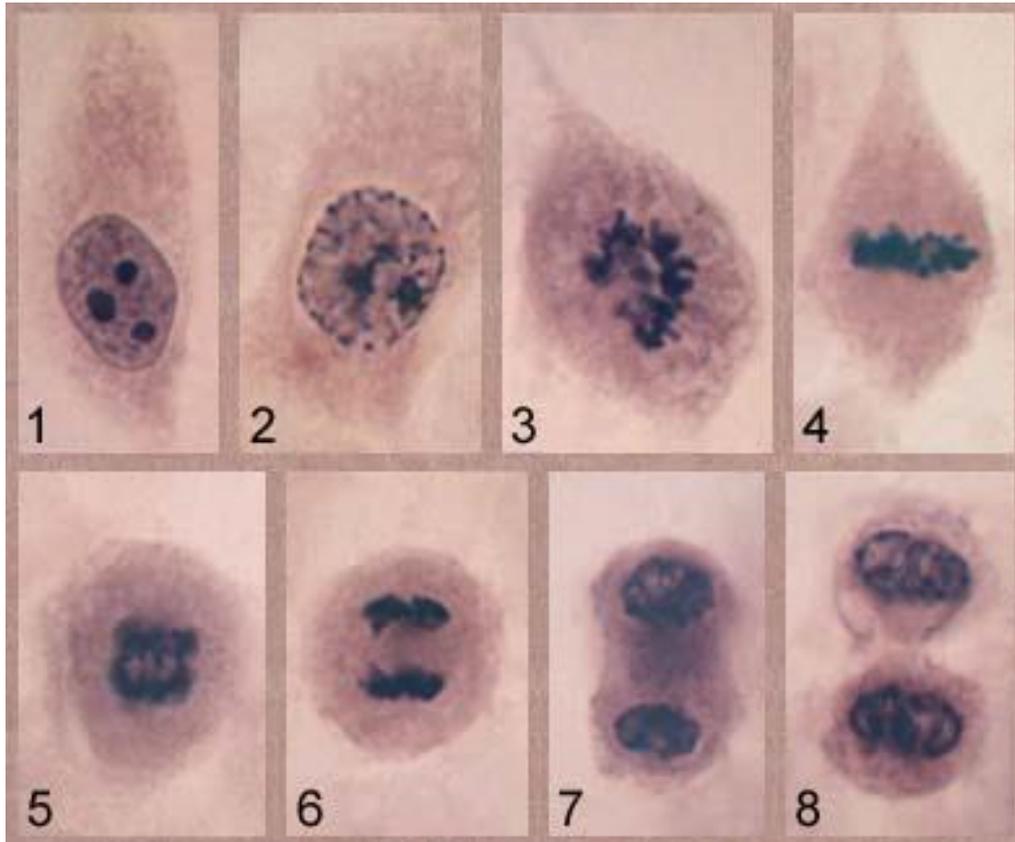


Figure 6. Plant cells in different stage of mitosis

8. Imagine that you are a geneticist and examine the karyotype. It is known that in the cells of the pig's 40 chromosomes. Specify the number of chromosomes and chromatids in each stage of mitosis and meiosis. Write the result in the table:

Phase of cell division	Type of cell division				Phase of cell division
	mitosis		meiosis		
	N chromosomes	N chromatids	N chromosomes	N chromatids	
Prophase					Prophase I
Metaphase					Metaphase I
Anaphase					Anaphase I
Telophase					Telophase I
					Prophase II
					Metaphase II
					Anaphase II
					Telophase II

9. Look carefully at the figure 7, find and label cells that are in each stage of mitosis

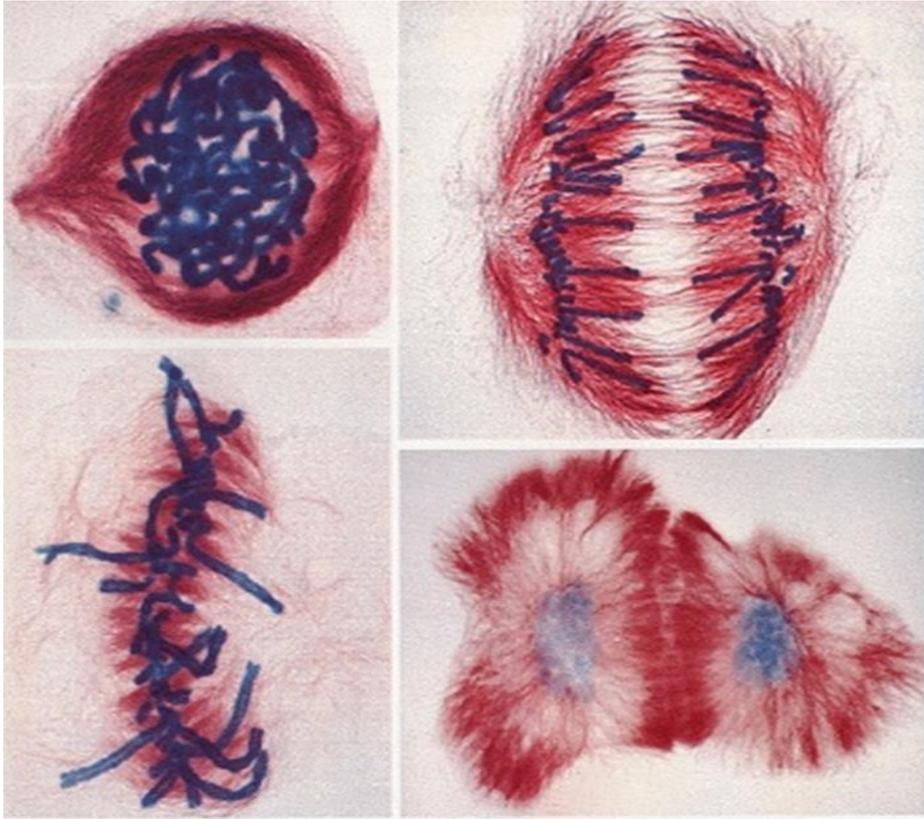


Figure 7. Plant cells in different stage of mitosis

10. Imagine that you are a geneticist and examine the karyotype. It is known that in the cells of the mouse 90 chromosomes. Specify the number of chromosomes and chromatids in each stage of mitosis and meiosis. Write the result in the table:

Phase of cell division	Type of cell division				Phase of cell division
	mitosis		meiosis		
	N chromosomes	N chromatids	N chromosomes	N chromatids	
Prophase					Prophase I
Metaphase					Metaphase I
Anaphase					Anaphase I
Telophase					Telophase I
					Prophase II
					Metaphase II
					Anaphase II
					Telophase II

11. Consider the photomicrograph shown in the *figure 8*:

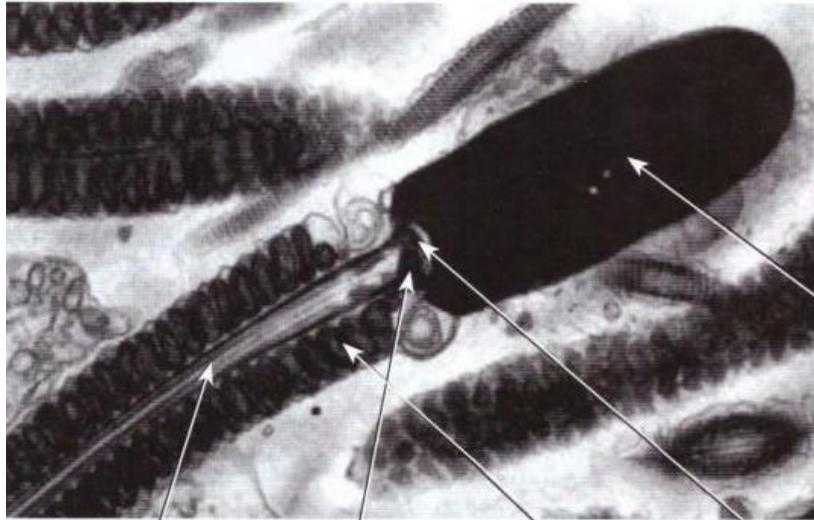


Figure 8. Photomicrograph of a human germ cell

Answer the questions:

- Which cell is shown in the photomicrograph?
- How many chromosomes and chromatids does it have, given that it belongs to a person?
- What type of division is this cell formed by?
- Sign the constituent parts of this structure, indicate which organelles they contain

12. Consider the photomicrograph shown in the *figure 9*:



Figure 9. Photomicrograph of a human germ cell

Answer the questions:

- Which cell is shown in the photomicrograph?
- How many chromosomes and chromatids does it have, given that it belongs to a person?
- What type of division is this cell formed by?
- Sign the constituent parts of this structure, indicate which organelles they contain

13. Consider the photomicrograph shown in the *figure 10*:

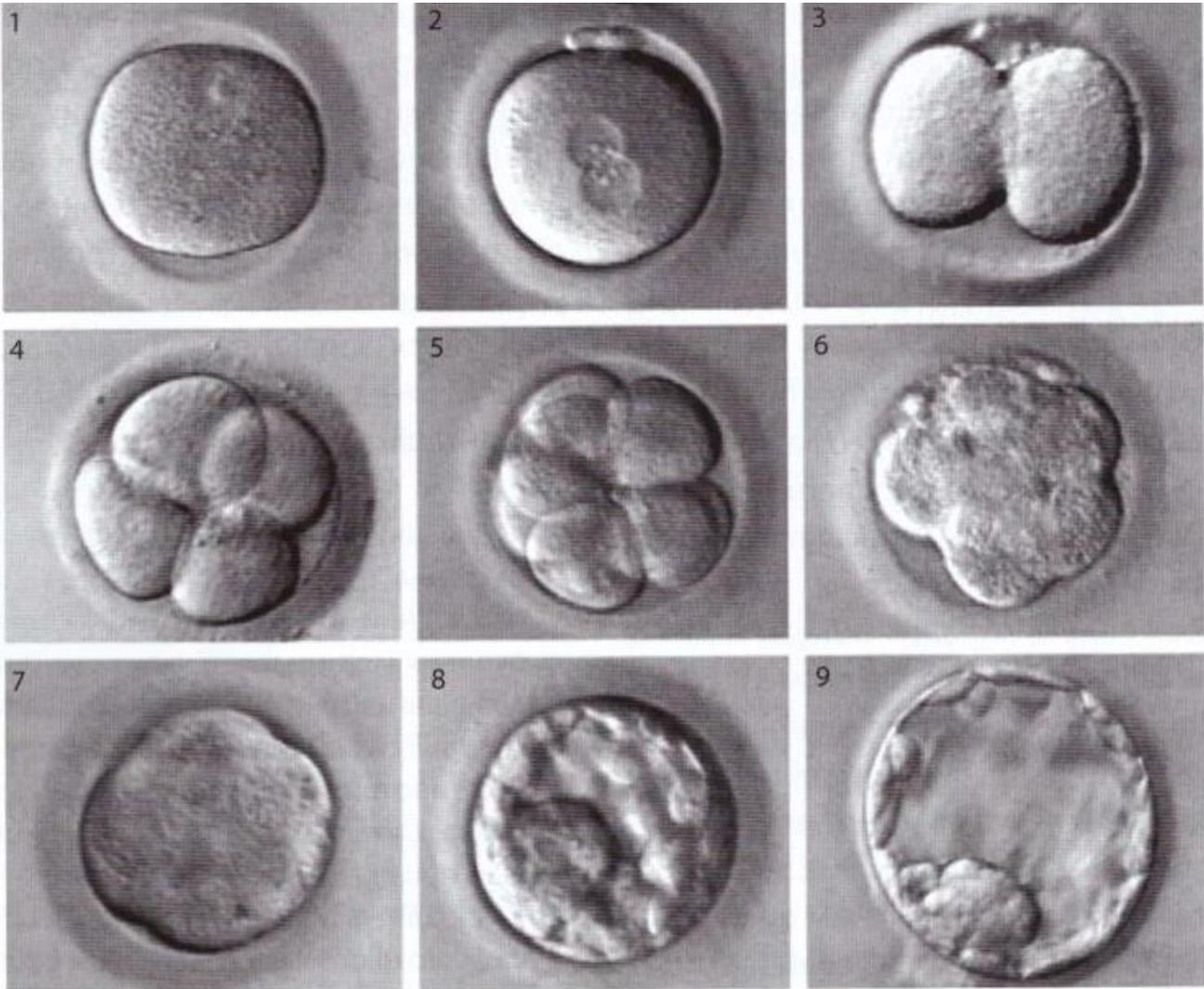


Figure 10. Scanning electron micrograph of the early stages of human embryogenesis

Answer the questions:

- Give the name of the stage of embryogenesis shown in the photomicrograph
- What type of division do cells reproduce?
- How does this type of division differ from ordinary mitosis?

14. Consider the photomicrograph shown in the *figure 11*:

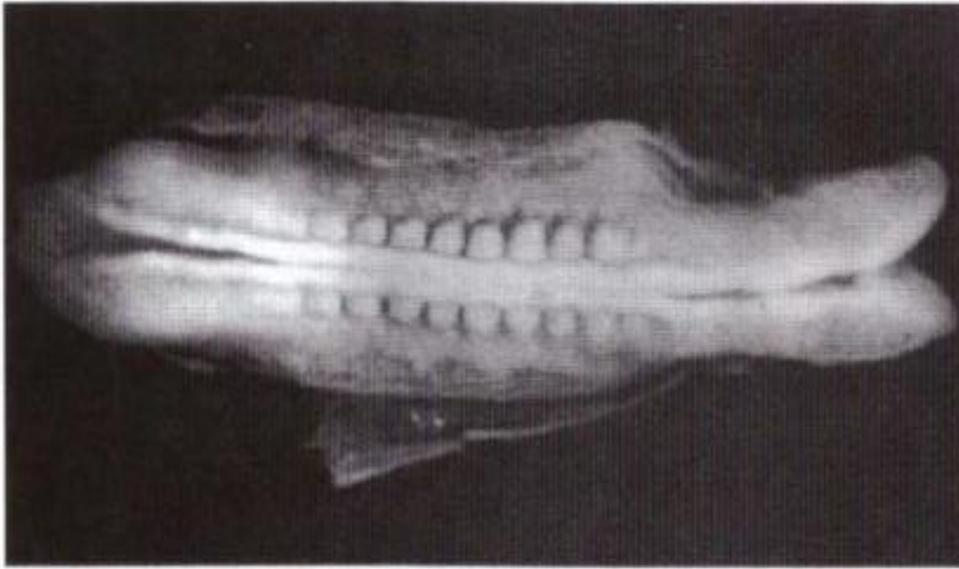


Figure 11. Human embryo on the 22nd day of embryogenesis

Mark the following components in the picture:

1. Cranial neuropore

2. Caudal neuropore

3. Neural tube

4. Somites

Define each marked concept

15. Consider the photomicrograph shown in the *figure 12*:



Figure 12. Photomicrograph of a temporary organ during pregnancy

Answer the questions:

- A. Enter the name of the body shown in the picture
- B. Specify the components marked with numbers 1-4
- C. What tissue is each labeled component made of?
- D. What are the functions of each labeled component?

16. Consider the photomicrograph shown in the figure 13:

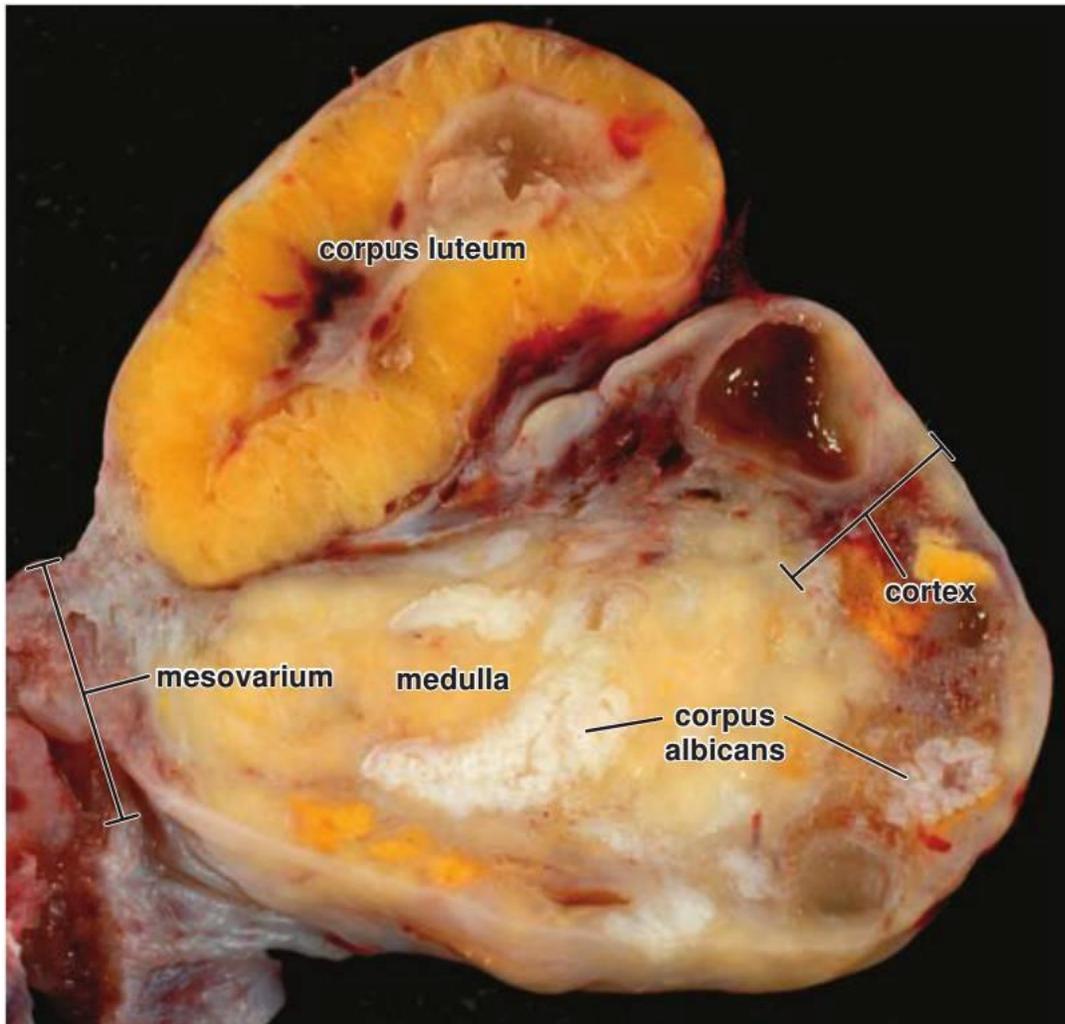


Figure 13. Photomicrograph of a temporary organ during pregnancy

Answer the questions:

- A. State the name of the body shown in the picture, what functions does it perform?
- B. What tissue is each labeled component made of?

17. Fill in the table: "Critical periods of human embryogenesis"

Name of the period	Weeks	Histological characteristics	Possible deviations

18. Complete the table by placing the structures listed below in the columns according to their origin:

nervous tissue, sensory organs, epidermis of the skin, skin glands, foregut, hindgut, epithelium of the digestive tract, digestive glands, chorda, lungs, thyroid gland, anterior and middle parts of the pituitary gland, skeleton, muscles, circulatory system, connective tissue layers of the skin, pleura, sexual and excretory organs.

Ectodermal origin	Endodermal origin	Mesodermal origin

19. Specify the correct sequence of main stages of development:

- A) morula — blastula — organogenesis — gastrula
- B) splitting — gastrula — blastocyst organogenesis
- C) zygote — gastrula — blastocyst organogenesis
- D) zygote — morula — blastocyst — gastrula — organogenesis

20. At early stages of human embryogenesis there arises a digitiform outgrowth of the ventral wall of the primitive gut rooting itself in the amniotic crus. What is the name of this extraembryonic organ?

- A. Yolk sac.
- B. Allantois.
- C. Amnion.
- D. Placenta.

21. In the course of the experiment on a frog embryo the external embryonic layer - ectoderm - has been destroyed. Which of the following morphological structures will stop its developed henceforth?
- A) Epidermis.
 - B) Somites.
 - C) Lung
 - D) Bowel
22. Zygote cell-division finishes after blastula formation. What type of blastula is specific of a human being?
- A) Discoblastula.
 - B) Celoblastula.
 - C) Blastocyst.
 - D) Amphiblastula.
23. During the third week of embryogenesis the central part of epiblast cells (ectoderm) sags and neurulation process begins. In which direction will the remaining ectodermal cells differentiate?
- B. Skin.
 - C. Somites.
 - D. Chord.
 - E. Yolk sac.
24. In a microscopic specimen of a human embryo, an embryonic plate has been detected with two cellular layers: endo- and ectoderm. At what stage of embryonal development is this embryo?
- A. Gastrulation.
 - B. Progenesis.
 - C. Neurulation.
 - D. Histogenesis.
25. Specify derivatives of endoderm:
- A) skeletal muscle
 - B) bones
 - C) the epithelium of the intestine
 - D) epithelium of the skin
26. Specify derivatives of mesoderm:
- A) heart muscle
 - B) liver
 - C) the brain
 - D) epithelium of the skin
27. Ectoderm is formed by all EXCEPT:
- A) neural tube;
 - B) the epidermis of the skin;
 - C) neural plate;

D) epithelium of the intestine;

28. Contact vzaimodeistviem germ cells include:

A) chemotaxis B) rheotaxis C) cortical reaction D) stereotactic

RECOMMENDED LIST OF SOURCES:

9. Барінов ЕФ, Чайковський ЮБ. Цитологія і загальна ембріологія: навчальний посібник. Київ: Медицина; 2010. 216 с.
10. Гістологічна термінологія. Міжнародні терміни з цитології та гістології людини / Федеративний міжнародний комітет з анатомічної термінології: переклад з англ. Вид. за ред. Ю.Б. Чайковського, О.Д. Луцика. К.: Медицина, 2010. 304 с.
11. Луцик О.Д. Гістологія. Цитологія. Ембріологія. Підручник. Вінниця «Нова книга», 2018. 592 с.
12. Медична ембріологія з основами тератології: навчальний посібник. Під ред. Чайковського. Вінниця: Нова Книга; 2019. 206 с.
13. Патоморфологія та гістологія: атлас [гістологія, патоморфологія, цитоморфологія] / Д. Д. Зербіно, М. М. Багрій, Я. Я. Боднар, В. А. Діброва.— Вінниця: Нова Книга, 2016. 800 с.
14. Спеціальна гістологія і ембріологія внутрішніх органів. Навчальний посібник. Під ред. Е.Ф. Барінова, Ю.Б. Чайковського. Київ, ВСВ «Медицина», 2013. 471 с.
15. Цитологія і загальна ембріологія. Навчальний посібник. Під ред. Е.Ф. Барінова, Ю.Б. Чайковського. Київ, ВСВ «Медицина», 2010. 216 с.
16. Kühnel W. Color Atlas of Cytology, Histology, and Microscopic Anatomy, 4th edition. Stuttgart: Georg Thieme Verlag; 2003. 534 p.
17. Leslie P. Gartner, James L. Hiatt. Color atlas and text of histology, Sixth Edition, 2014. 525 p.
18. Melnyk, N.O. Histology, cytology and embryology. K.: Book-plus, 2017. 416 p.
19. Ross, M.H. Pawlina W. Histology: a Text and Atlas with Correlated Cell and Molecular Biology. 7-th ed. Philadelphia : Wolters Kluwer, 2016. 984 p.
20. Ross, M.H. Pawlina W. Histology: a Text and Atlas with Correlated Cell and Molecular Biology. 6-th ed. Philadelphia : Wolters Kluwer, 2010. 974 p.
21. Scott, F. G. Developmental Biology. 9th Ed. Palgrave, 2013.
22. Wilson, J. Hunt T. Molecular Biology of the Cell, Fifth Edition. The Problems Book. 5th Ed. Garland Science, 2008.

INTERNET SOURCES:

1. <https://uahistory.co>
2. <http://www.healthcare.uiowa.edu/anatomy/dental/oralhist/>
3. http://www.histology.be/digital_microscope_histology_.html
4. <http://www.kumc.edu/instruction/medicine/anatomy/histoweb/>

4. TASKS FOR INDEPENDENT WORK FOR CONTENT MODULE 3. HISTOLOGICAL BASES OF ONTOGENESIS

TOPIC: «COMMON FEATURES OF THE TISSUES»

1. What are the structures that are formed as a result of cell fusion, the loss of their boundaries, the formation of a common cytoplasmic mass with nuclei:
 - a) simplast
 - b) syncytium
 - c) differon
 - d) intercellular substance
2. How we call the structure arising as a result of incomplete cytotomy at cell division:
 - a) simplast
 - b) syncytium
 - c) differon
 - d) intercellular substance
3. What is the set of all cells making the line of a differentiation from the stem cells to the most mature differentiated?
 - a) simplast
 - b) syncytium
 - c) differon
 - d) intercellular substance
4. How we call the least differentiated cells of the tissue being a source of development of its other cells?
 - a) simplast
 - b) syncytium
 - c) differon
 - d) stem cells
5. How we call the process, during which cells pass a number of stages of development gradually getting structural and functional properties of mature elements?
 - a) development
 - b) grow
 - c) differon
 - d) differentiation

Topic: "EPITHELIAL TISSUES"

1. What are the two basic types of epithelium do you know?
2. What are the main characteristics of epithelial tissue?
3. What are the main functions of epithelial tissue?
4. What is the difference between exocrine and endocrine glands?
5. Give examples of exocrine and endocrine glands?
6. What are the criteria for classification of the membranous epithelium?
7. What is the difference between simple and stratified epithelium?
8. How many layers has pseudostratified epithelium?
9. What type of epithelium can stretch without damage?
10. Where we can find transitional epithelium in our body?
11. What types of glands are divided according to the number of cells they consist of?
12. What is the difference between simple and compound endocrine glands?
13. What types of glands, depending on the shape of the secretory department, you know?
14. What types of glands, depending on the consistency of their secret, you know?
15. What type of secretion do you know?

16. Consider the histopreparation shown in the *figure 14*:

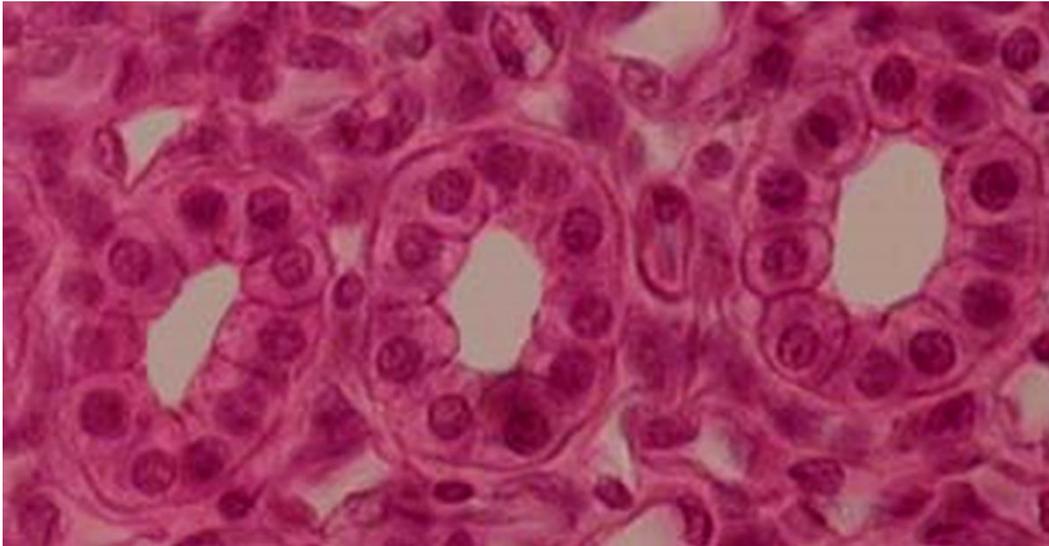


Figure 14. Histological preparation of human tissue

- 1) specify the name of the tissue depicted on the tissue preparation
- 2) specify the name of the dye that was used in the preparation of this tissue preparation

3) indicate the location of the tissue depicted on the tissue preparation in the human body

4) Make the following marks on the drawing:

1 – nucleus 2 – cytoplasm 3 – basement membrane

17. Consider the histopreparation shown in the *figure 15*:

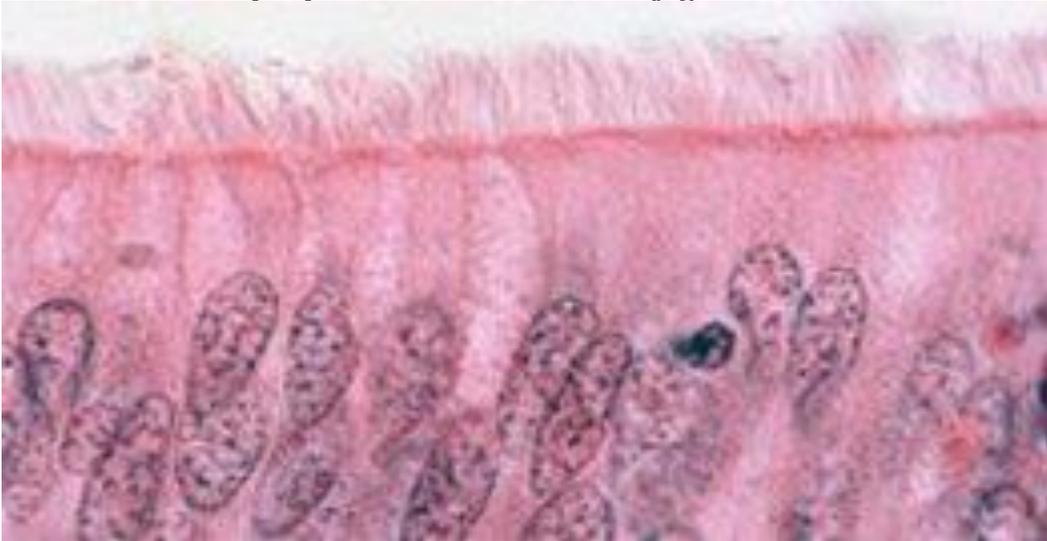


Figure 15. Histological preparation of human tissue

1) specify the name of the tissue depicted on the tissue preparation

2) specify the name of the dye that was used in the preparation of this tissue preparation

3) indicate the location of the tissue depicted on the tissue preparation in the human body

4) Make the following marks on the drawing:

1 – nucleus 2 – cytoplasm 3 – basement membrane 4 – cilia

18. Sign the types of secretion of the glandular epithelium shown in the *figure 16*

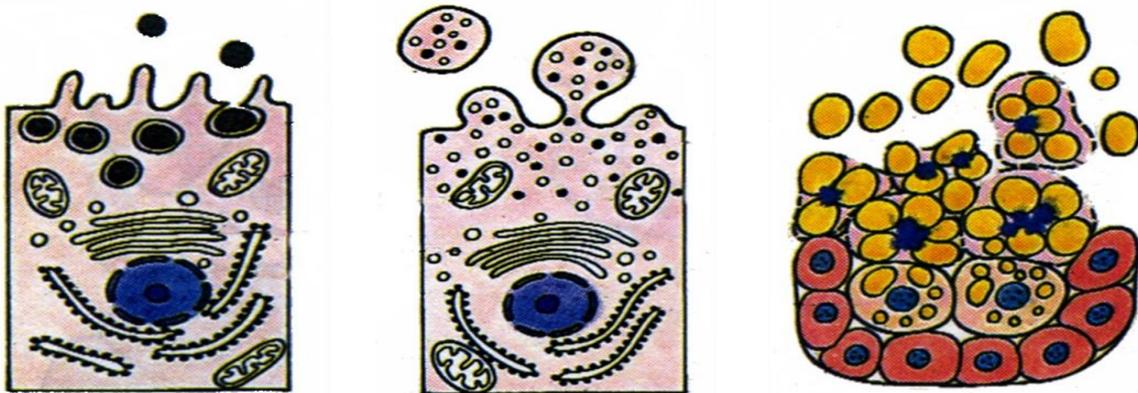


Figure 16. Glandular epithelium

Indicate which glands in the human body have each type of secretion?

TOPIC: «CONNECTIVE TISSUES»

1. On a tissue specimen in a connective tissue the large cells filled with basophilic metachromatic granules are found out; they contain heparin and histamine. What cells are found out in a preparation?

A. Tissue basophils (mast cells)	B. Adipocytes	C. Iasmocytes
D. Fibroblasts	E. Macrophages	

2. During the trainings at the sportsman the lag was injured. The doctor-traumatologist diagnosed a break of a tendon. What type of a connective tissue forms this structure?

A. Reticular	B. Cartilage	C. Dense irregular
D. Loose fibrous connective	E. Dense regular	

3. With age human skin undergoes changes, which may declare themselves by reduction of skin elasticity. What structures of connective tissue provide skin elasticity most of all?

A. Cells of epidermis.	B. Ground substance.
C. Collagen and elastic fibers.	D. Connective tissue cells.
E. Reticular fibers.	

4. One of the rules of surgery is performing sections along the so-called lines of Langer (lines of skin tension). What tissue forms the reticular (the strongest) layer of derma?

A. Reticular connective tissue.	B. Dense irregular connective tissue.
C. Loose connective tissue.	D. Epithelial tissue.
E. Dense regular connective tissue.	

5. Which of the following is NOT primarily composed of connective tissue?

A. Bone marrow	B. Articular cartilage	C. Heart
D. Mesenchyme	E. Fat	

6. Which of the following can be classified as "connective tissue proper"?

A. Adipose tissue	B. dense irregular connective tissue	
C. Bone	D. Blood	E. Cartilage

7. What type of tissue is a tendon composed of?

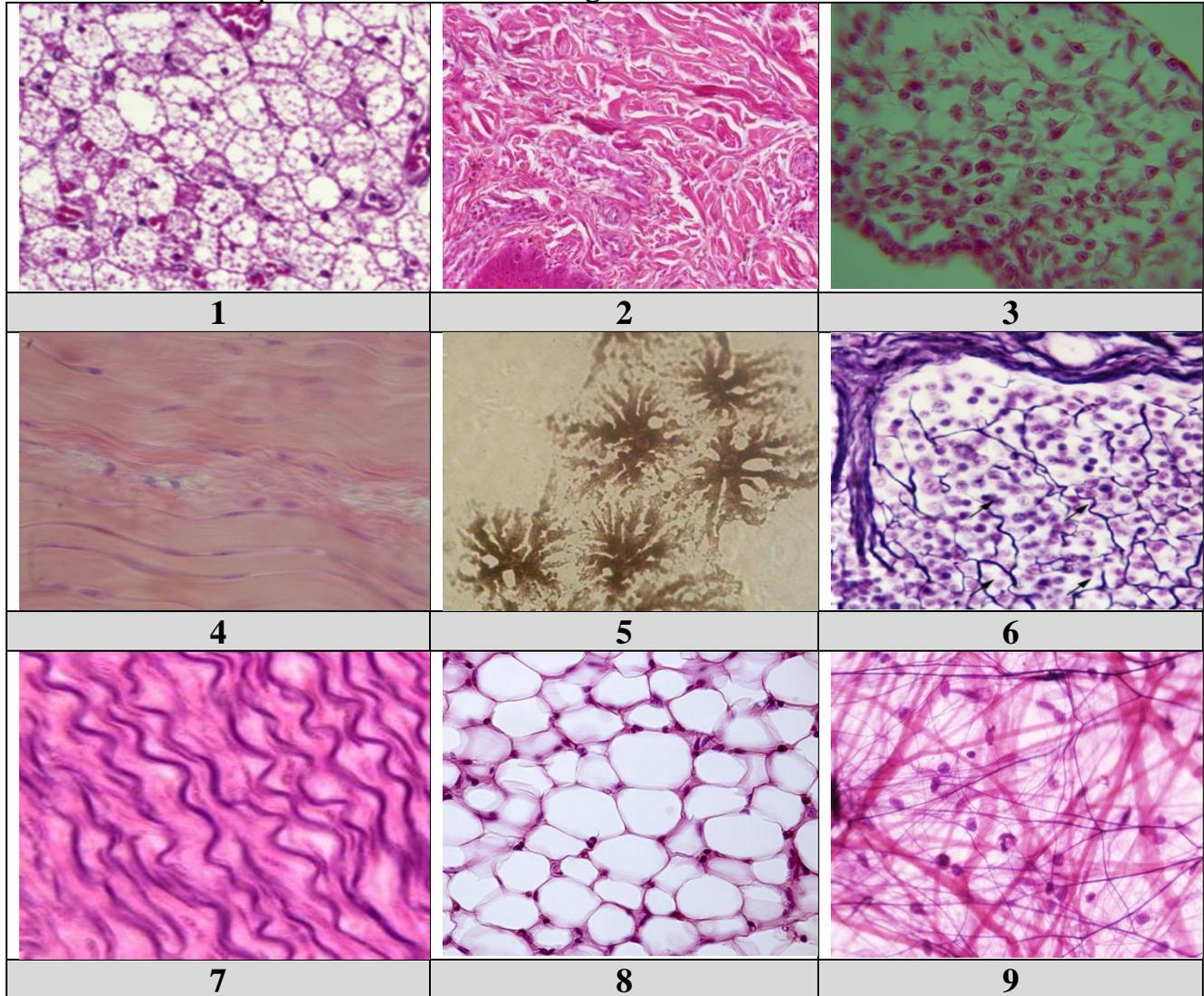
A. Mucous connective tissue	B. Mesenchyme
C. Loose irregular connective tissue	D. Dense irregular connective tissue
E. Dense regular connective tissue	

8. What does connective tissue develop from?

A. Mesothelium	B. Mesenchyme	C. Mesangial cells	D. Mesentery
E. Wharton's jelly			

9. Which of the following is a component of the ground substance?
 A. Hyaluronic acid B. Proteoglycans C. Glycosaminoglycans
 D. Chondroitin sulfate E. All of the above

10. Find the correspondence between the figures and their titles



- A. Elastic connective tissue
- B. Reticular tissue of lymphoid node
- C. Yellow adipose tissue
- D. Brown adipose tissue
- E. Pigment cells
- F. Mesenchyma the chicken embryo
- G. Dense regular collagenous connective tissue
- H. Loose areolar connective tissue
- Dense irregular collagenous connective

TOPIC: «BLOOD AND LIMPH»

1. At research of a tissue specimen of a connective tissue the neutrophils are defined. What function do these cells execute, entering from a blood into a tissue?

A. Adjust reductions of smooth myocytes	D. Phagocytosis of microorganisms
B. Nutritive	E. Dilate blood vessels
C. Trophyc	

2. The reduced haemoglobin content in a blood is revealed. What function of a blood will be disturbed?

A. Transport of gases
B. Transport of hormones
C. Maintenance of immunity
D. Clotting
E. Transport of nutritive substances

3. In a blood smear among leukocytes the spherical cells with segmented nuclei prevail. The line granules in their cytoplasm are stained both acidic and basic dyes. How are these cells called?

A. Neutrophils	B. Basophils
C. Eosinophils	D. Juvenile neutrophils

4. At damage of blood vessels there is a spontaneous stop of a bleeding. Name formed element of blood, which first of all takes part in blood clotting?

A. Platelets	B. Leukocytes
C. Erythrocytes	D. Lymphocytes

5. During histochemical investigation of leucocytes of blood smear, cells with heparin and histamine in their granules were found. What cells are these?

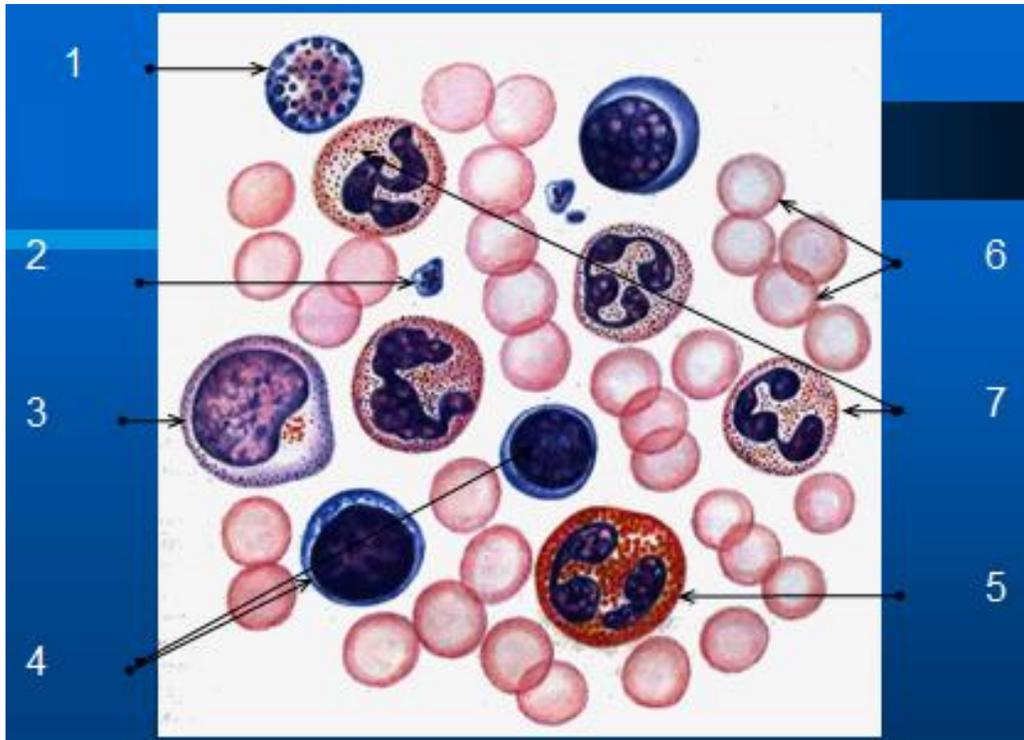
A Basophils	B Neutrophils
C Eosinophils	D Monocytes

6. At the second contact of antigen with macro-organism, antibodies are produced by the latter. To the function of what immunocompetent cells is this phenomenon related?

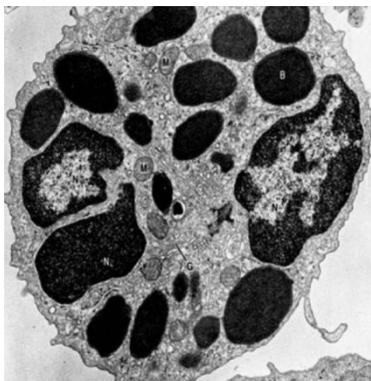
A Memory B-lymphocytes	B T-killers
C T-suppressors	D Macrophages

7. Find the correspondence between the figures in the picture and names of blood cells

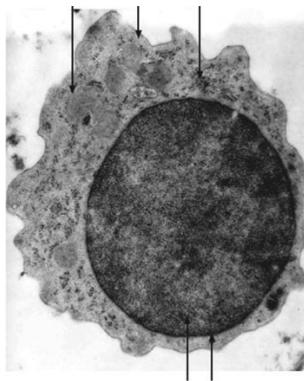
A) red blood cells	D) basophils	
B) eosinophils	E) monocytes	
C) neutrophils	F) lymphocytes	G) platelets



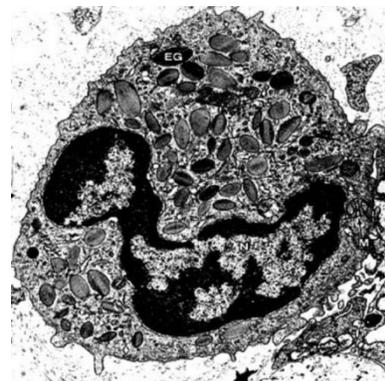
8. Find the correspondence between the electron photomicrographs and names of blood cells



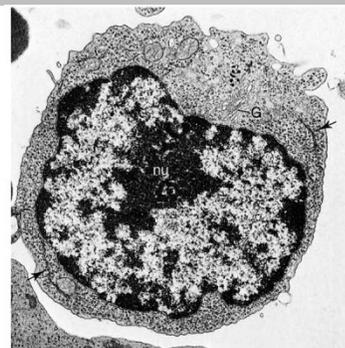
1



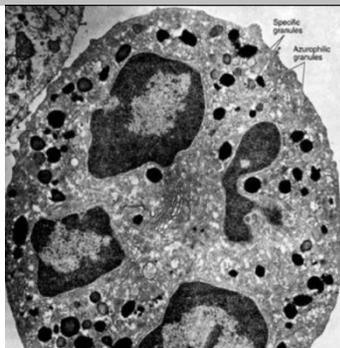
2



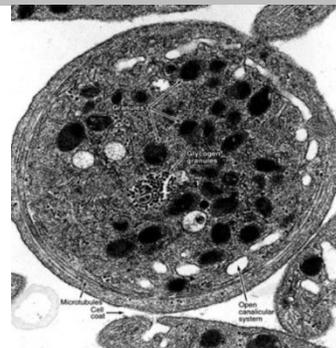
3



4



5



6

- A) eosinophils
- B) neutrophils

- C) basophils
- D) lymphocytes

- E) monocytes
- F) platelets

TOPIC: «SKELETAL CONNECTIVE TISSUES»

1. Which tissue will have damaged underarthritis, when interfacial slip of the joint are broken state?

- A. Reticular tissue B. Fibrocartilage C. Bone tissue
D. Lose connective tissue E. Hyaline cartilage

2. A patient has excessive resorption of bones detected. With the increased activity of what osteal tissue cells is it connected?

- A. Osteoblasts. B. Osteoblasts and osteoclasts.
C. Osteocytes and osteoblasts. D. Osteoclasts. E. Osteocytes.

3. On your most recent visit to the local piercing parlor, you have several new holes pierced along the auricle of your ear. Arrange in order the constituents encountered by the needle as it passes through your skin and into the cartilage in your ear.

1: Chondroblasts

2: Chondrocytes

3: Chondrogenic layer of the perichondrium

4: Fibrous layer of the perichondrium

5: Interterritorial matrix

6: Territorial matrix

A. 4 - 3 - 1 - 5 - 6 - 2

B. 4 - 1 - 3 - 6 - 5 - 2

C. 4 - 6 - 5 - 1 - 3 - 2

D. 4 - 3 - 1 - 6 - 5 - 2

E. 4 - 3 - 5 - 1 - 6 - 2

4. Which type of cartilage is characterized by the presence of chondrocytes sitting in lacunae?

- A. Hyaline cartilage B. Elastic cartilage C. Fibrocartilage
D. All of the above E. None of the above

5. Which type of cartilage forms the articular surface on bones?

- A. Hyaline cartilage
B. Elastic cartilage
C. Fibrocartilage
D. All of the above
E. None of the above

6. Which type of cartilage is found in the external ear?

- A. Hyaline cartilage
B. Elastic cartilage

- C. Fibrocartilage
- D. All of the above

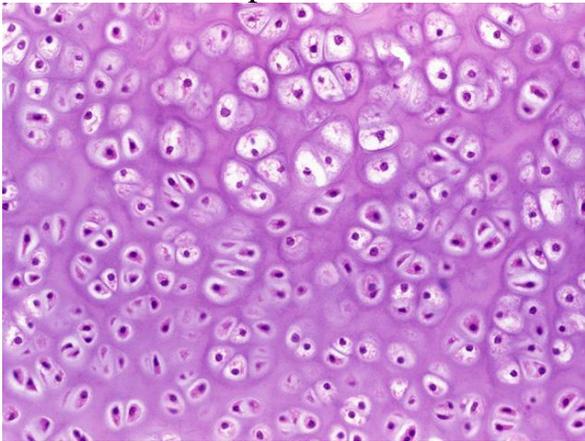
7. What is the cylindrical structure in compact bone?

- A. Osteoclast
- B. Osteon
- C. Osteocyte
- D. Osteoblast
- E. Osteoid

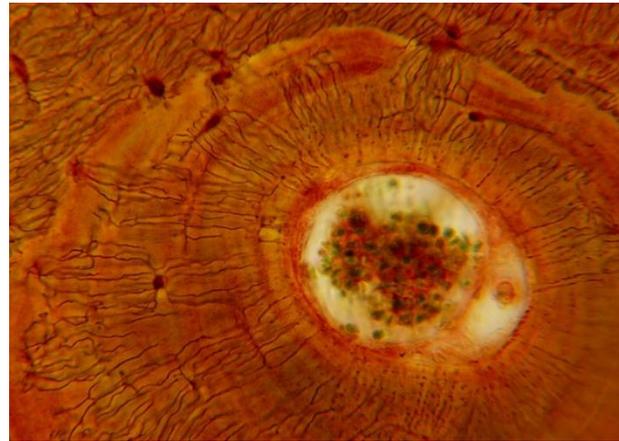
8. What cell is an immature bone cell?

- A. Osteoclast
- B. Osteon
- C. Osteocyte
- D. Osteoblast
- E. Osteoid

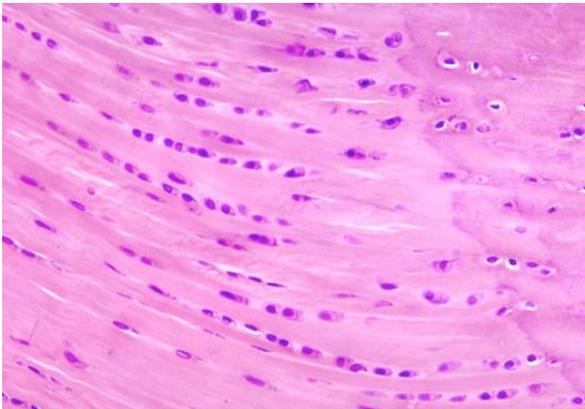
9. Find the correspondence between the pictures and its names



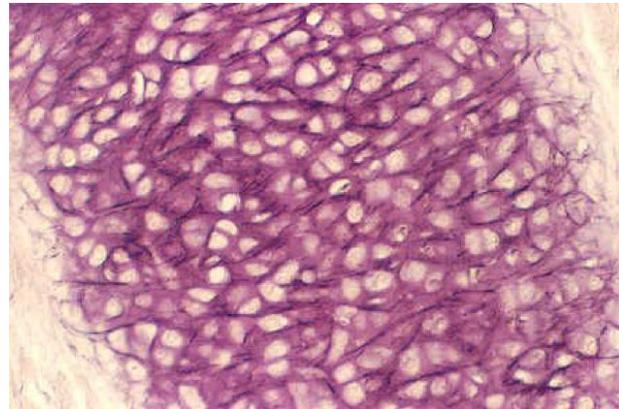
1



2



3



4

- A) Yellow elastic cartilage
- B) Hyaline cartilage
- C) Fibrous cartilage
- D) Osteon

TOPIC: «MUSCULAR TISSUES»

1. Cells of rectangular shape by a size 50-120 μm with the centrally located nucleus, well developed myofibrils, connected with one another by intercalated disk are defined in the micropreparation of the heart. What is a function of these cells?
 A. Regenerative B. Conducting of nervous impulses C. Endocrine
 D. Contraction of the heart

2. Destruction of thin myofilaments is observed during the research of a striated muscle fiber after the action of hydrolytic ferments. Which structures have been damaged?
 A. Actin myofilaments. B. Tonofibrils.
 C. T-systems. D. Sarcoplasmic reticulum.

3. You have just received your free flu shot in a skeletal muscle of your arm. Arrange in order the structures that the needle passed through as it penetrated your muscle.
 1 = epimysium 2 = myofibril 3 = perimysium
 4 = sarcoplasmic reticulum 5 = endomysium 6 = sarcolemma
 A. 1 - 2 - 3 - 4 - 5 - 6 B. 1 - 6 - 3 - 2 - 4 - 5
 C. 1 - 5 - 3 - 6 - 4 - 2 D. 1 - 3 - 5 - 6 - 4 - 2

4. The atrophy of the muscles what appeared as a result of dysbolism of the proteins is discovered at patient. Name the protein what participates in formation of the thin myofilaments?
 A. Actin B. Tubulin C. Dinein D. Desmin E. Keratin

5. The fibers containing numerous nucleuses are seen in preparation of muscle tissue. The nucleuses are situated peripheral. What type of tissue is presented in preparation?
 A. Skeletal muscle. B. Cardiac muscle. C. Smooth muscle.
 D. Myoepithelial cells.

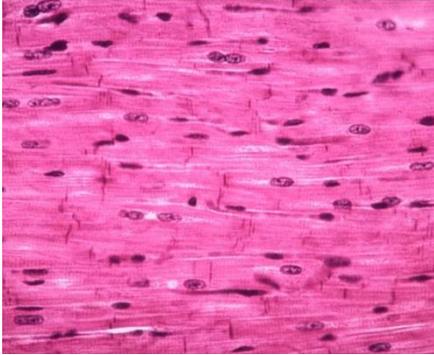
6. What is actin? A. Myofilament B. Myosin C. Muscle fibers D. Myofibrils
 E. Myocardium

7. Which of the following is composed of smooth muscle?
 A. Upper esophagus B. Heart C. Tongue D. Biceps muscle
 E. Walls of the visceral organs

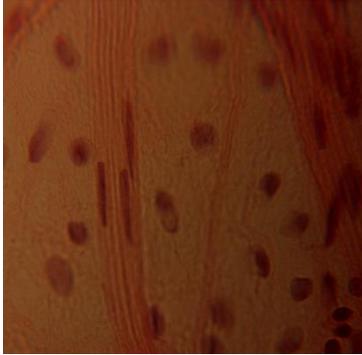
8. On the histological specimen of the heart, it was distinguished cells of rectangular form by sizes ranging from 50 to 120 μm , with centrally located nuclei, well-developed myofibrils, coupled together with the help of intercalated disks. Choose the function which is coupled with these cells:

A Contraction of heart B Conducting of impulses C Endocrine D
 Protective E Regenerative

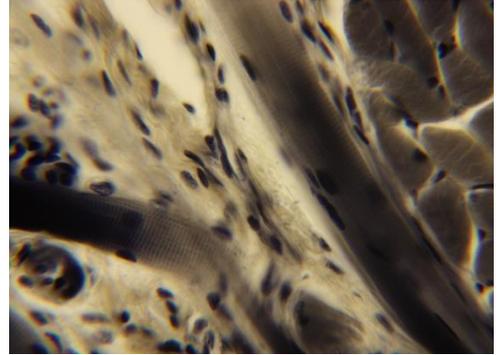
9. Find the correspondence between the photo and name the type of muscle tissue



1



2



3

- A) Skeletal striated muscle tissue
- B) Striated cardiac muscle tissue
- C) Smooth muscle tissue

TOPIC: «NERVOUS TISSUES»

1. The patient has degenerative pathology of the spinal cord during which the neurons with 4-5 processes are damaged. What type of neurons do they belong to?

- A. Unipolar B. Monopolar C. Bipolar D. Pseudounipolar
- E. Multipolar

2. In conditional experiment the action of toxic substance breaks the mechanism of spreading of a nerve impulse along the nerve cell. What frame does this function execute?

- A. Chromophilic substance B. Neurofibril C. Synapse
- D. Mitochondrion E. Nerve cell membrane

3. During injury of a brain neuroglial cells are damaged. What type of neuroglial cells is predominantly arranged in the grey matter of the brain?

- A. Oligodendrocytes
- B. Microglia C. Protoplasmic astrocytes D. Fibrous astrocytes E. Schwann cells

4. During a conditional experiment the action of a toxic substance enhances the mechanism of nerve impulse transfer. What structure provides this function?

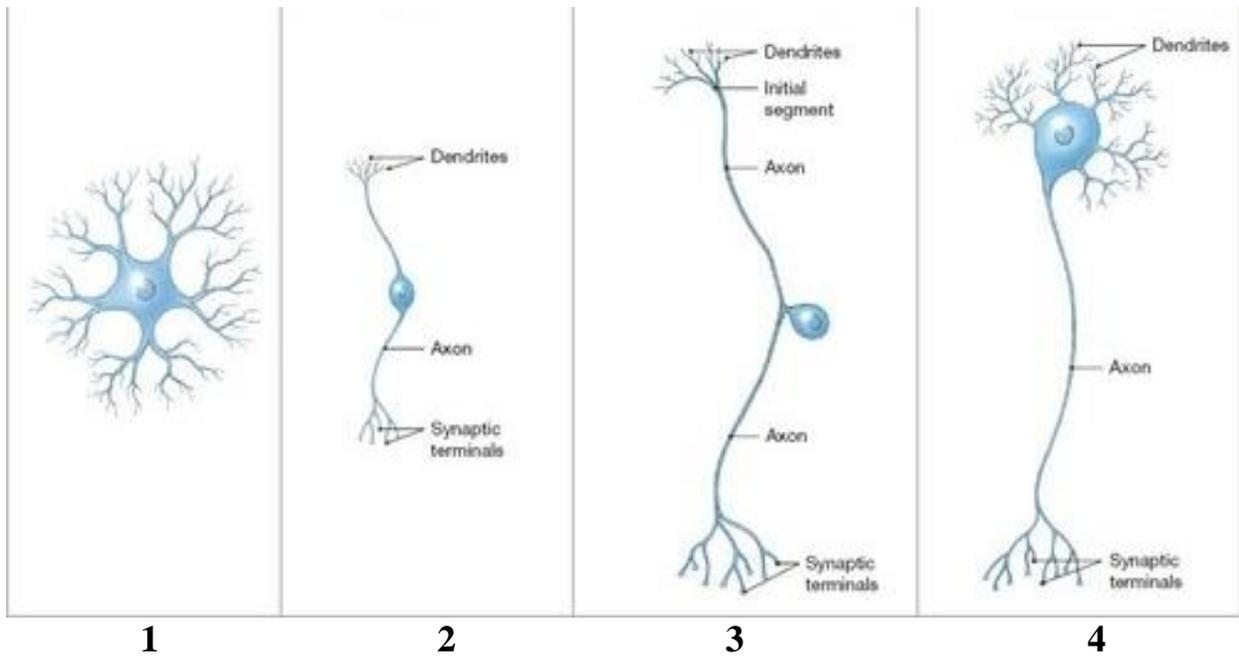
- A. Neurofibril. B. Neurolemma. C. Synapse. D. Mitochondrion.
- E. Nissl's substance.

5. A sensory nerve ganglion consists of roundish neurocytes with one process that divides into axon and dendrite at a certain distance from perikaryon. What are such cells

called? A Pseudounipolar B Unipolar C Bipolar D Multipolar
E Apolar

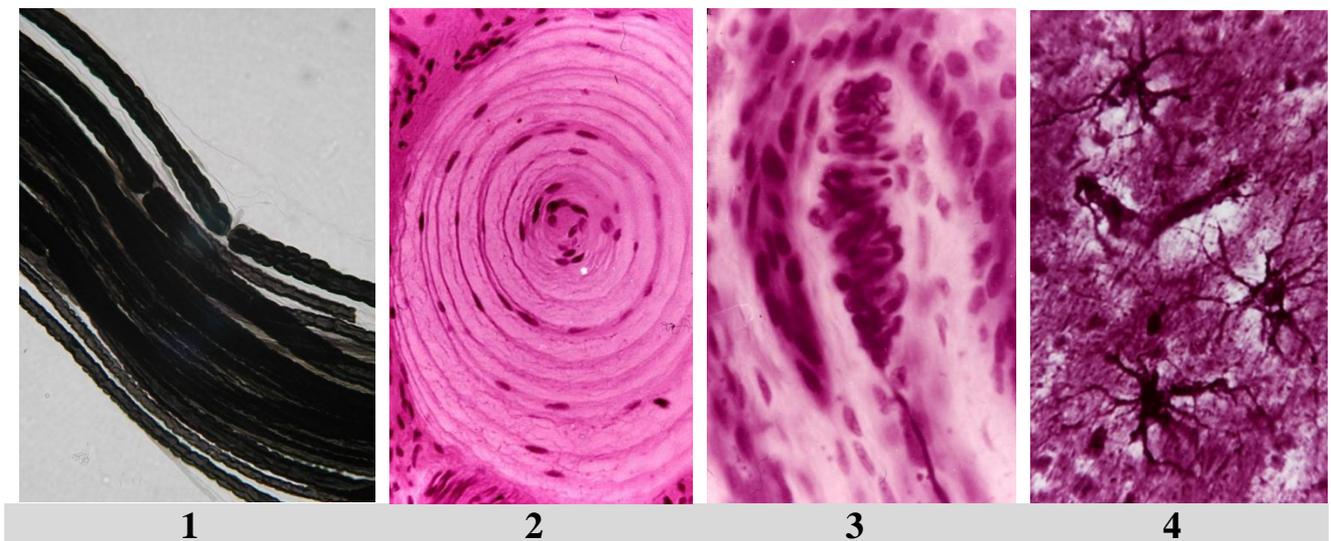
6. Which cells are microglia
A Glial macrophages B Oligodendrocytes C Astrocytes

7. Find the correspondence between the figures and their titles



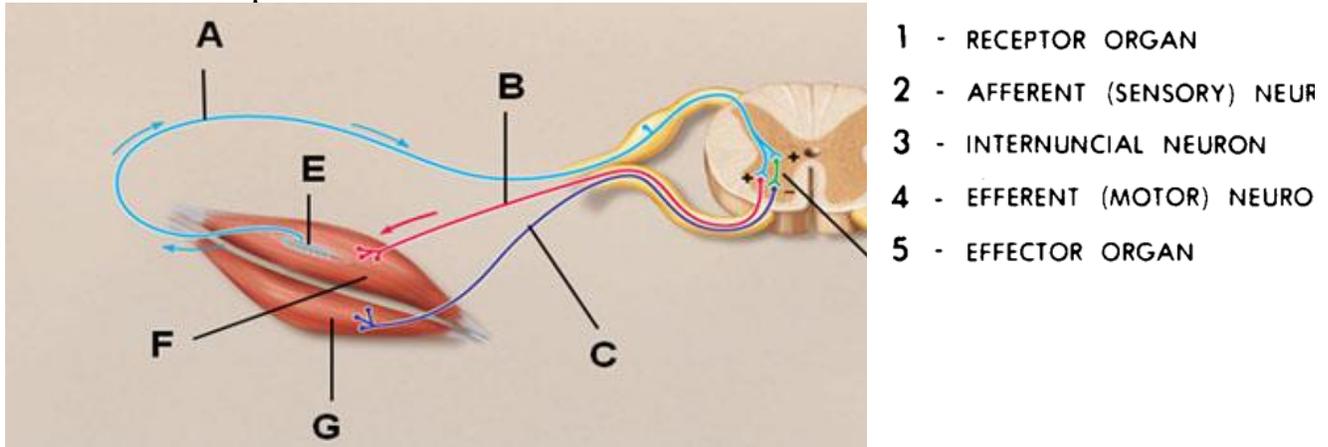
A Pseudounipolar B Unipolar C Bipolar D Multipolar E Apolar

8. Find the correspondence between the figures and their titles



- A) Tactile corpuscles of Meisner
- B) Lamellated corpuscles of Pacini
- C) Myelinated nerve fibers
- D) Astrogliaocytes

9. Find the correspondence between letters and numbers



RECOMMENDED LIST OF SOURCES:

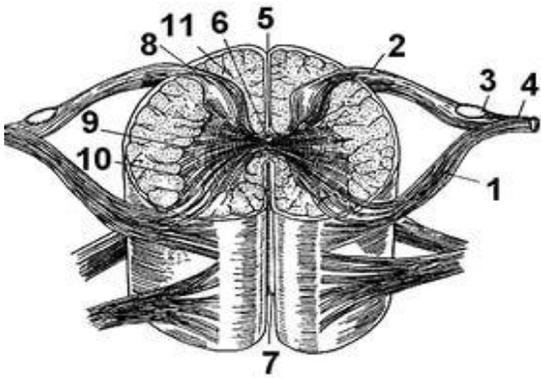
1. Гістологія, цитологія та ембріологія. Атлас = Histology, cytology and embryology = Гистология, цитология и эмбриология : навч. посіб. Для студ. вищ. навч. закл. - мед. ун-тів, ін-тів й акад. / О. Ю. Степаненко [та ін.] ; рец.: С. Б. Геращенко, В. І. Шепітько. Київ: ВСВ "Медицина", 2017. 152 с.
2. Гістологія. Цитологія. Ембріологія : підручник для студ. стомат. ф-ту. / Луцик О.Д., Чайковський Ю.Б. (за ред.). Вінниця : Нова Книга, 2020. 496 с.
3. Гістологія. Короткий курс : навч. посіб. для самостійної підготов. До практик. занять, підсумкових модулів та іспиту "Крок-1" / Г. І. Козак [та ін.] ; за ред.: Ю.Б. Чайковського ; рец.: О. Д. Луцик, М. С. Пушкар ; МОЗ України, Нац. мед. ун-т ім. О. О. Богомольца. Вінниця: Нова книга, 2016. 336 с.
4. Луцик О.Д. Гістологія. Цитологія. Ембріологія. Підручник. Вінниця «Нова книга», 2018. 592 с.
5. Патоморфологія та гістологія: атлас [гістологія, патоморфологія, цитоморфологія] / Д. Д. Зербіно, М. М. Багрій, Я. Я. Боднар, В. А. Діброва.— Вінниця: Нова Книга, 2016. 800 с.
6. Практикум з цитології, ембріології та загальної гістології. Навчальний посібник/ Під ред. Е.Ф. Барінова, Ю.Б. Чайковського. Київ: ЦМК ВМО МОЗ України, 2000.
7. Чайковський Ю.Б., Дельцова О.І., Геращенко С.Б. Практикум з гістології, цитології та ембріології. Навчальний посібник. Київ – Івано-Франківськ, 2000.
8. Чайковський Ю.Б., Сокурєнко Л.М. Гістологія, цитологія та ембріологія. Атлас

для самостійної роботи студентів. Луцьк, 2006. 152 с.

9. Kühnel W. Color Atlas of Cytology, Histology, and Microscopic Anatomy, 4th edition. Stuttgart: Georg Thieme Verlag; 2003. 534 p.
10. Leslie P. Gartner, James L. Hiatt. Color atlas and text of histology, Sixth Edition, 2014. 525 p.
11. Melnyk, N.O. Histology, cytology and embryology. К.: Book-plus, 2017. 416 p.
12. Ross, M.H. Pawlina W. Histology: a Text and Atlas with Correlated Cell and Molecular Biology. 7-th ed. Philadelphia : Wolters Kluwer, 2016. 984 p.
13. Ross, M.H. Pawlina W. Histology: a Text and Atlas with Correlated Cell and Molecular Biology. 6-th ed. Philadelphia : Wolters Kluwer, 2010. 974 p.

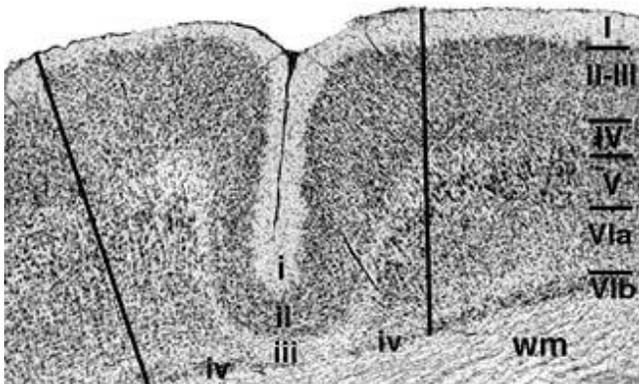
INTERNET SOURCES:

1. https://semmelweis.hu/anatomia/files/2020/02/20200211Kocsis_alapszovetek_bor.pdf
2. https://essuir.sumdu.edu.ua/bitstream-download/123456789/76739/1/Hryntsova_tsytolohiia_atlas.pdf;jsessionid=4A4ACCC50C43CBE7E5BB130FCF81A4FB
3. <https://studfile.net/preview/5943797/>
4. <http://histology.medicine.umich.edu/>
5. <http://histologyatlas.wisc.edu/>
6. <http://intranet.tdmu.edu.ua/data/kafedra/internal/histolog.../>
7. <http://library.med.utah.edu/WebPath/HISTHTML/HISTO.html>
8. <http://synapses.clm.utexas.edu/atlas/contents.stm>



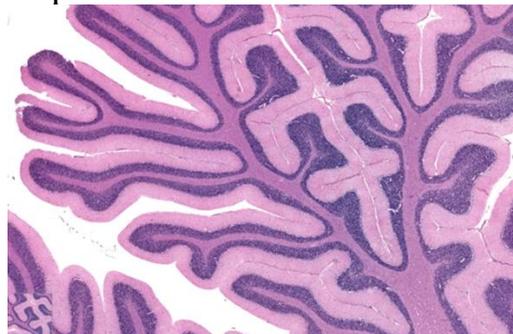
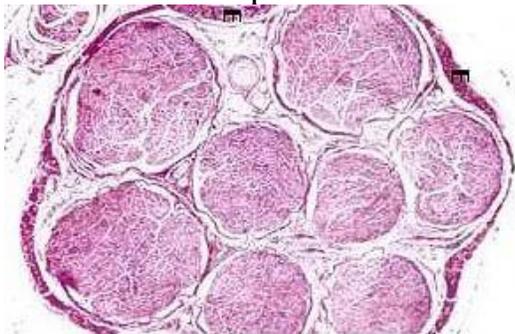
- a) sensitive neuron
- b) dorsal root
- c) ventral root
- d) motor neuron

8. Find the correspondence between the figures in the picture and the names of the layers of the cerebral cortex

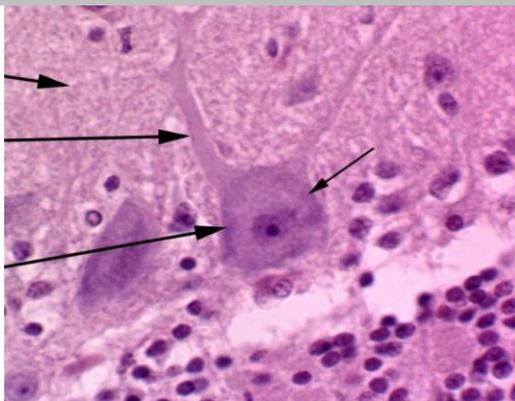


- a) multiform layer
- b) inner granular layer
- c) external granular layer,
- d) inner pyramidal layer
- e) external pyramidal layer
- f) molecular layer

9. Find the correspondence between the pictures and its names



- A. Purkinje Cell
- B. Cross section of nerve
- C. Scvann cell
- D. Cross section of the cerebellum



1

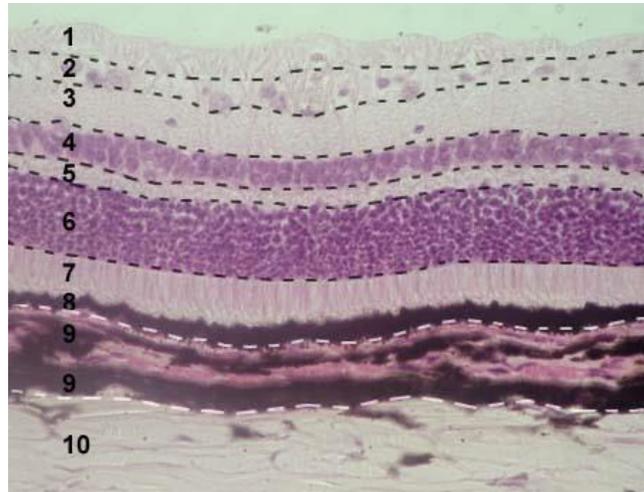
2

3

4

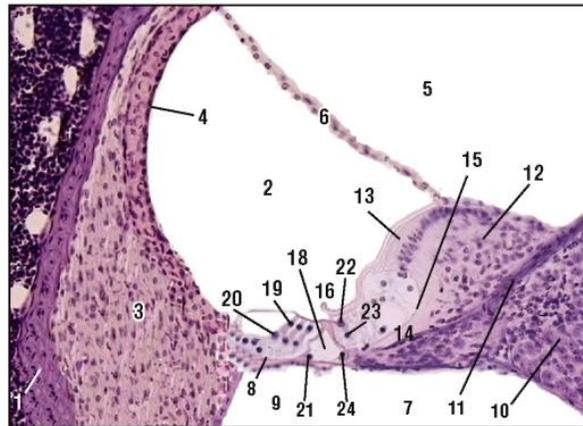
7. Find the correspondence between the numbers in the figure and letters sclera

- a) outer plexiform layer
- b) inner nuclear layer
- c) ganglionic layer
- d) outer nuclear layer
- e) layer of rods and cones
- f) pigment epithelium
- g) actually-vascular sheath
- h) inner plexiform layer
- i) nerve fiber layer

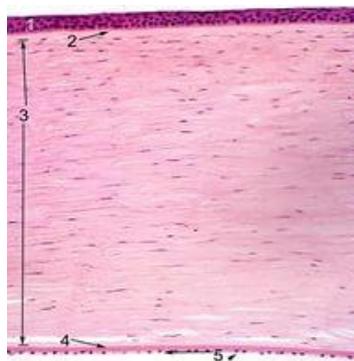
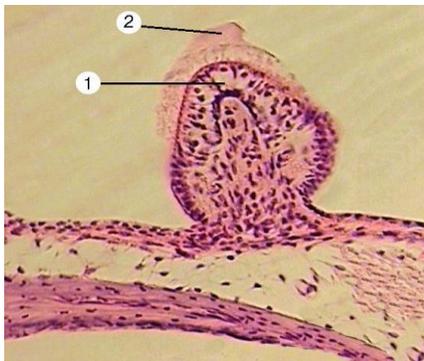


8. Find the correspondence between the numbers in the figure and letters Westibularnaya membrane

- a) Basement membrane
- b) Hair cells
- c) Stria vascularis
- d) Bony wall of cochlea



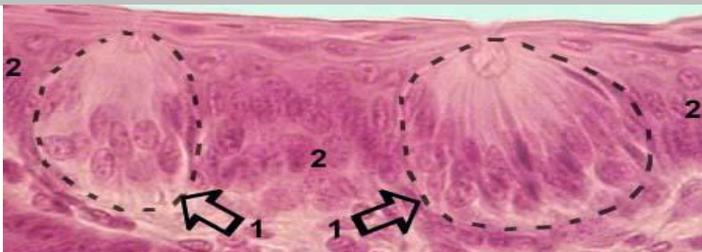
9. Find the correspondence between the numbers in the figure and letters



- a) taste analyzer
- b) organ of equilibrium
- c) cornea of the eye

1

2



3

TOPIC: SKIN

1. Histological study of a microslide of human skin found only dense irregular connective tissue. Which layer of this organ was analysed?
 A Reticular dermis
 B Papillary dermis
 C Subcutaneous adipose tissue
 D Epidermis
 E Basal layer of epidermis

2. A patient complains of dryness of head skin, itching, fragility and loss of hair. After examination he was diagnosed with seborrhea. Disturbed activity of which cells caused this condition?
 A Cells of sebaceous glands
 B Cells of sudoriferous glands
 C Epithelial cells
 D Adipocytes
 E Melanocytes

3. Study of fingerprints (dactylography) is used by criminalists for personal identification as well as for diagnostics of genetic abnormalities, particularly Dawn's disease. What layer of skin determines individuality of fingerprints?
 A Dermopapillary
 B Horny
 C Reticular
 D Clear (stratum lucidum epidermidis)
 E Basal

4. In a biopsy material of the skin, in the epidermis were revealed cells with sprouts with granules of brown color in cytoplasm. What kind of cell is it?
 A Melanocytes
 B Intraepidermal macrophages
 C Keratinocytes
 D Merkel cells
 E Lymphocytes

5. The cells of basal layer of epidermis suffered under influence of radiation. What function of epidermis will attenuate or upset foremost?
 A Regenerative
 B Protective
 C Barrier
 D Absorbtion
 E Dielectric

6. The terminal portions of apocrine sweat-glands are contained by myoepithelial cells. What is the function of these cells?
 A Contractile
 B Secretory
 C Protective
 D Regeneration
 E Supporting

7. At the patient of 30 years the malignant tumor of skin was found out. What cells of epidermis do take part in an immune response?

- A T-lymphocytes
- C Keratinocytes and Merkel cells
- E Cells of spinous layer

- B Keratinocytes
- D Merkel cells

8. On a histological specimen an organ of the stratified type structure, covered by a multi-layered flattened keratinized epithelium is presented. Under the basal membrane of the epithelium there is loose connective tissue which forms papillae. Located below is the dense irregular connective tissue is which forms the reticular layer. What organ has this morphological signs?

- A Skin
- C Tonsils
- E Esophagus

- B Neck of uterus
- D Tong

9. On a histological specimen is a biopsy material of the epidermis of the skin. The skin is that of a healthy adult man. In a basal layer it was evidenced cells which were dividing. What process do these cells provide?

- A Physiological regeneration
- C Adaptation
- E Apoptosis

- B Differentiation
- D Reparative regeneration

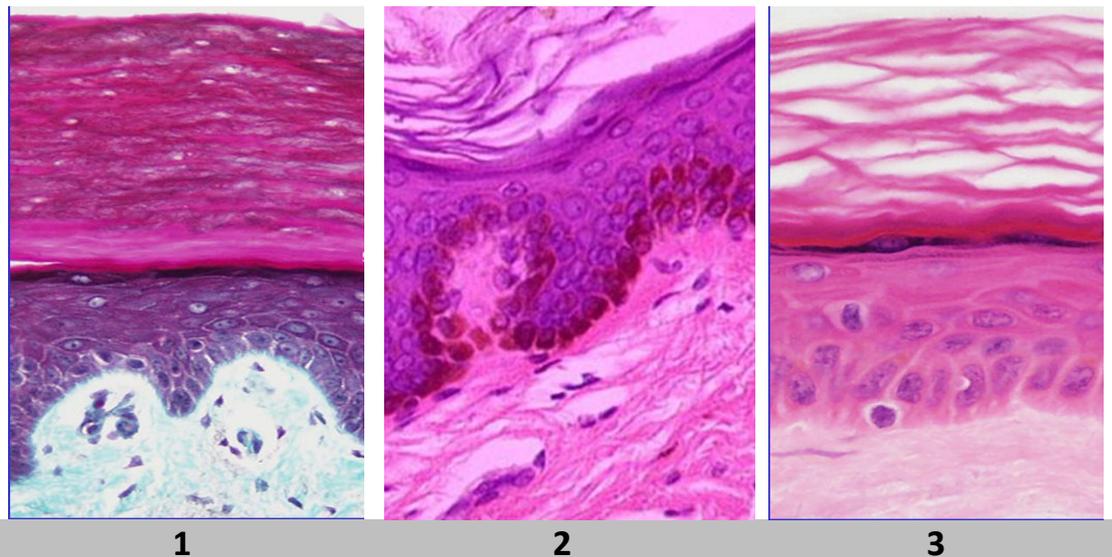
10. With age, skin wrinkles and folds appear. Changes in what structures of the skin mainly cause this state?

- A Elastic fibers
- C Epidermis
- E Hypoderm

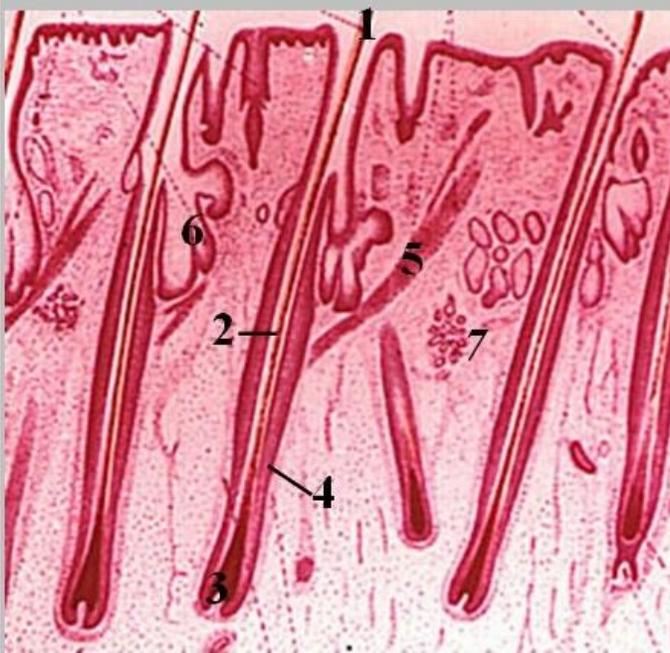
- B Collagen fibers
- D Ground substance

11. Find the correspondence between the numbers in the figure and letters

- a) Pigmented skin
- b) Thin skin
- c) Thick skin



12. Find the correspondence between the numbers in the figure and letters



- A. Sebaceous gland
- B. Sweat gland
- C. The root of the hair
- D. The hair axis
- E. The surface of the epidermis
- F. A muscle that raises hair

TOPIC: CARDIOVASCULAR SYSTEM

1. A histological specimen shows a blood vessel. Its inner coat is composed by endothelium, subendothelium and internal elastic membrane. The middle coat is enriched with smooth myocytes. Such morphological characteristics are typical for the following vessel: A Elastic-type artery B Muscular-type artery C Capillary D Non-muscular vein E Muscular-type vein
2. A histological specimen presents an artery. One of the membranes of its wall has flat cells lying on the basal membrane. What type of cells is it? A Endothelium B Mesothelium C Smooth myocytes D Fibroblasts E Macrophages
3. On microscopic specimen is presented an organ of the circulatory system. One of its envelopes is built from fibers which anastomose one with another. These fibers are made up of cells which are united one with another with the intercalated disks. What it is an organ? A Heart B Vein of muscular type C Artery of muscular type D Artery of elastic type E Arteriole
4. On a histological specimen, stained with orcein, on the middle envelope of vessel it was discovered 40 to 60 elastic membranes. Name this vessel. A Artery of muscular type B Artery of elastic type C Vein of muscular type D Vein of non-muscular type
5. On a histological specimen, it is observed a vessel, the wall of which consists of endothelium, basal membrane and loose connective tissue. Name the type of vessel?

A Vein of muscular type B Artery C Vein of non-muscular type D Hemocapillary
E Lymphocapillary

6. On histological specimen a blood vessel is observed. An internal envelope consists of endothelia, subendothelia and internal elastic membrane. The middle envelope enriched by smooth muscle cells. Indicate the vessel

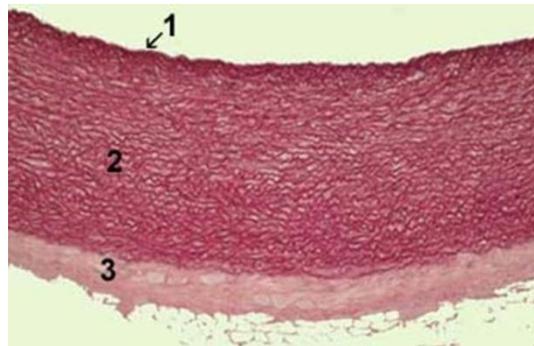
A Arteries of elastic type B Arteries of muscular type C Capillary
D Veins of non-muscular type E Veins of muscular type

7. On specimen a blood vessel is presented. An internal envelope is presented by endothelium and subendothelium, middle envelope - by the bundles of smooth muscle cells, layers loose connective tissue. An external envelope is strongly developed and formed by envelope and separate smooth muscle cells. What vessel does have this morphological description?

A Artery of elastic type B Artery of muscular type C Vein of non-muscular of type
D Artery of the mixed type E Veins of muscular type

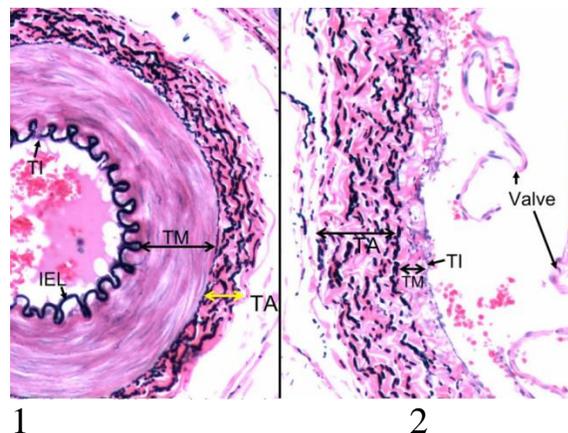
8. Find the correspondence between the numbers and letters:

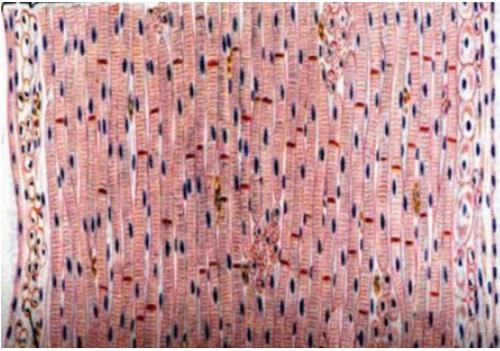
A Tunica intima
B Tunica adventitia
C Tunica media



9. Find the correspondence between the pictures and its names:

A Elastic-type artery
B Muscular-type artery
C Capillary
D Non-muscular vein
E Muscular-type vein

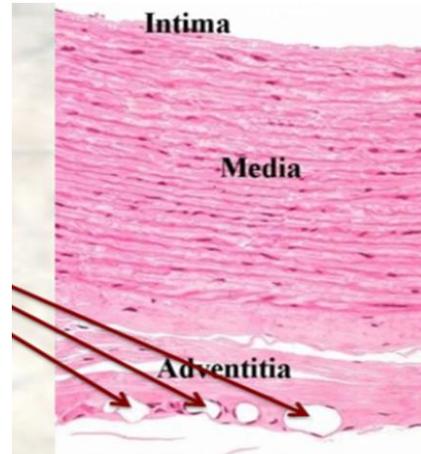




10. Which element of the cardiovascular system has this muscle tissue?
- A) artery
 - B) veins
 - C) capillaries
 - D) heart

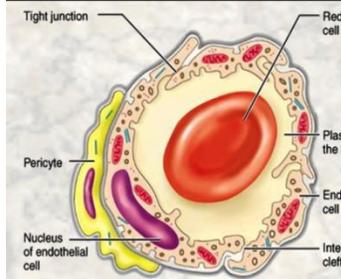
11. What is the structure in the figure, shown by the arrows?

- A) Continuous capillary
- B) Discontinuous capillary
- C) Fenestrated capillary
- D) Vasa vasorum

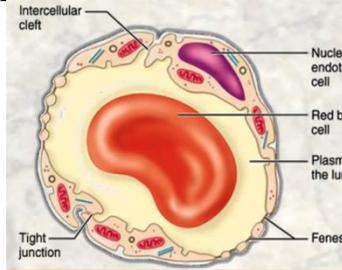


12. Find the correspondence between the pictures and its names

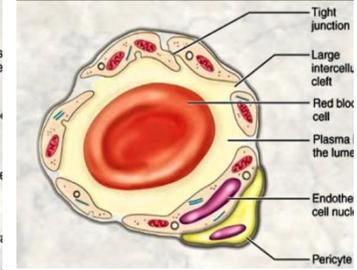
- A) Continuous capillary
- B) Discontinuous capillary
- C) Fenestrated capillary



1



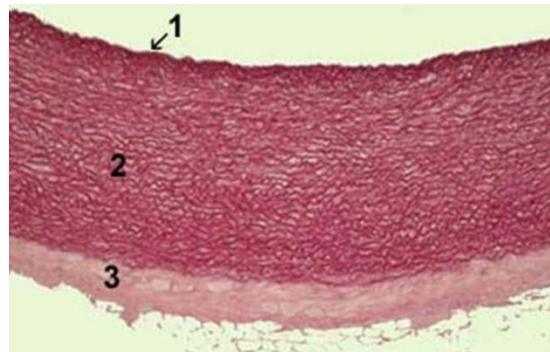
2



3

13. Such imagine typical for the following vessel:

- A Elastic-type artery
- B Muscular-type artery
- C Capillary
- D Non-muscular vein
- E Muscular-type vein



TOPIC: ENDOCRINE SYSTEM

1. Microscopic examination of a parenchymatous organ revealed that its epithelial cords formed glomerular, fascicular and reticular zones. The central part of the organ was presented by accumulations of chromaffin cells. Specify this organ:

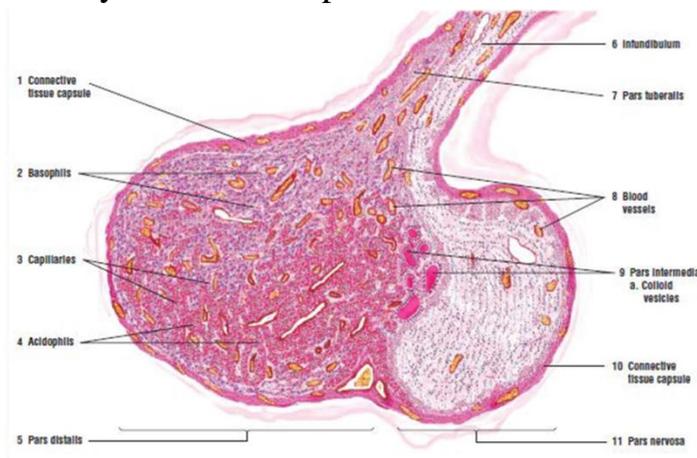
A Adrenal gland B Thyroid gland C Epiphysis D Liver E Hypophysis

2. A 37 year old patient complains about permanent thirst, poor appetite. He drinks 9 l water per day. Daily diuresis is increased, urine is colourless, its relative density is 1,005. The most probable cause of this pathology development is damage of:

A Hypothalamic nuclei B Epithelium of renal tubuli C Adenohypophysis
D Epiphysis

3. Parodontitis is treated with calcium preparations and a hormone that stimulates tooth mineralization and inhibits tissue resorption. What hormone is it? A Calcitonin B Parathormone C Adrenalin D Aldosterone E Thyroxine

4. Name the glands, which you see on the photo



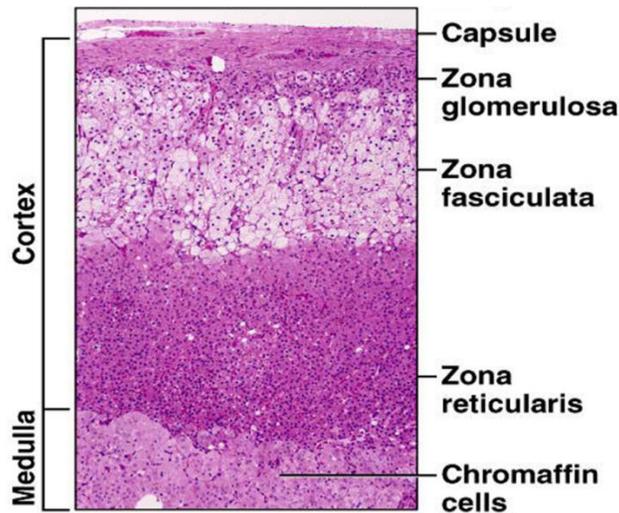
5. On the specimen of one of endocrine glands the rounded structures of different sizes are seen, the wall of which is formed by one layer of epithelial cells on basal membrane. Inwardly these structures contain homogeneous noncellular mass. What gland is it?

A Thyroid gland B Adrenal gland C Parathyroid gland D Anterior hypophysis E Posterior hypophysis

6. A patient has an elevated excretion of urine during the day. Due to the lack of secretion of what hormone of hypothalamus is it possible to explain this phenomenon?

A Vasopressin B Oxytocin C Liberin D Statin E Thyriod

6. Name the glands, which you see on the photo



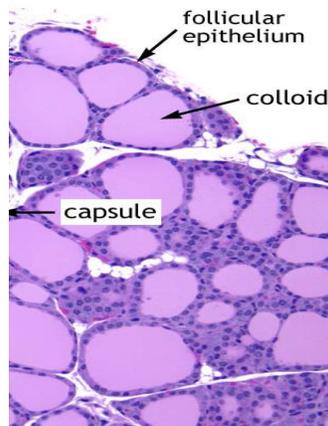
7. Kidneys of a man under examination show increased resorption of calcium ions and decreased resorption of phosphate ions. What hormone causes this phenomenon?

- A Parathormone B Thyrocalcitonin C Hormonal form D3 D Aldosterone
E Vasopressin

8. An endocrinal gland with parenchyma consisting of epithelium and neural tissue is under morphological examination. Epithelial trabecules have two types of cells: chromophilic and chromophobic. Identify this organ:

- A Hypophysis B Adrenal glands C Hypothalamus D Thyroid gland
E Parathyroid gland

9. Name the glands, which you see on the photo



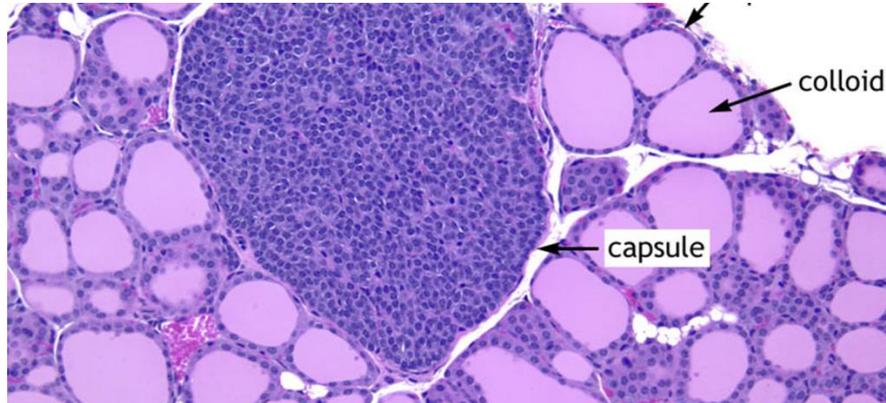
10. At a patient of 42 after the operation of resection of thyroid gland, cramps appeared. A facilitation came at infusion of calcium. Dysfunction of what glands does cause this state? A Parathyroid glands B Adrenal glands C Ovaries D Hypophysis E Epiphysis

11. At X-ray examination of bones of the base of skull it was revealed enlargement of cavity of Sella turcica ("Turkish saddle"), thinning of anterior inclined projection,

destruction of different parts of Sella turcica. Tumor of what endocrine gland could lead to such destruction of bones?

A Hypophysis B Epiphysys C Thymus D Adrenal gland E Thyroid gland

12. Name the glands, which you see in the center of the photo



13. Find the correspondence between the gland, its hormones and its functions

Glands	Hormones	Effects
I. Adrenal glands (cortex)	1. ACTH (adrenocorticotrophic hormone)	A. Promotes the growth of body tissues
II. Adrenal glands (medulla)	2. ADH (antidiuretic hormone)	B. Promotes the milk production
	3. Aldosterone	C. Stimulates thyroid hormone secretion
III. Parathyroid glands	4. Calcitonin	D. Stimulates the release of hormones by the adrenal cortex
	5. Cortisol, Corticosterone, Cortisone	E. Stimulates the gamete production
IV. Pineal gland	6. Epinephrine, Noradrenaline	F. Stimulates the androgen production through gonads
	7. Follicle stimulating hormone (FSH)	G. Stimulates water absorption of the kidneys
V. Pituitary (anterior)	8. Growth hormone	H. Stimulates uterine contractions during childbirth
VI. Pituitary (posterior)	9. Luteinizing hormone (LH)	I. Stimulates basal metabolic rate
	10. Melatonin	J. Reduces Ca ²⁺ blood level
VII. Thyroid	11. Oxytocin	K. Increases Ca ²⁺ blood level
	12. Parathyroid hormone	L. Increases Na ⁺ blood level
	13. Prolactin	M. Increase blood sugar level
	14. Thyrothropin (TSH)	N. Stimulates fight or flight reaction
	15. Thyroxin (T ₄); Triiodothyronine (T ₃)	O. Controls sleep cycles

TOPIC: RESPIRATORY SYSTEM

1. Study of a tubular organ revealed that its median membrane consists of solid hyaline rings. What epithelium lines mucous membrane of this organ?
 A Multinuclear prismatic ciliated B Monostratal prismatic glandular
 C Monostratal prismatic with a border D Multistratal squamous nonkeratinizing
 E Monostratal cubical

2. A patient was admitted to the hospital with an asphyxia attack provoked by a spasm of smooth muscles of the respiratory tracts. This attack was mainly caused by alterations in the following parts of the airways:
 A Small bronchi B Median bronchi
 C Large bronchi D Terminal bronchioles E Respiratory part

3. Electronic microphotography of pulmonary alveole's wall presents a big cell. Its cytoplasm has a lot of mitochondria, developed Golgi apparatus, osmiophil lamellated corpuscles. What is the main function of this cell?
 A It produces surfactant B It is a component of blood-air barrier
 C It warms the air D It purifies the air E It absorbs microorganisms

4. At the worker of chemical manufacture after inspiration of a caustic pair death of part of ciliary epitheliocytes of bronchi was observed. What cells will take place in regeneration of this epithelium?
 A Basal cells B Goblet cells C Endocrine cells
 D Ciliary cells E Cells without cilia

5. On an electronic photomicrograph, it is observed structures, presented as opened sacs, lined from the internal surface with simple epithelium, which consists of respiratory and secretory cells. Which structures are these?
 A Alveoli B Bronchioles
 C Acini D Small bronchus E Terminal bronchioles

6. The syndrome of respiratory insufficiency develops at prematurely born children. Insufficiency of which component of the aero-hematic barrier causes this pathology?
 A Surfactant B Endothelium of capillaries
 C Basal membrane of endothelium D Basal membrane of alveolocytes
 E Alveolocytes

7. On a histological specimen of trachea a pseudostratified ciliary epithelium is observed with comparatively low cells of oval or three-cornered form. They do not have the apical surface of epithelium. In several cells the process of mitosis is visible. What is the function of these cells?

- A Regeneration
 C Secrete mucus
 E Secrete biologically active substances
- B Represent a part of mucociliary complex
 D Secrete a surfactant

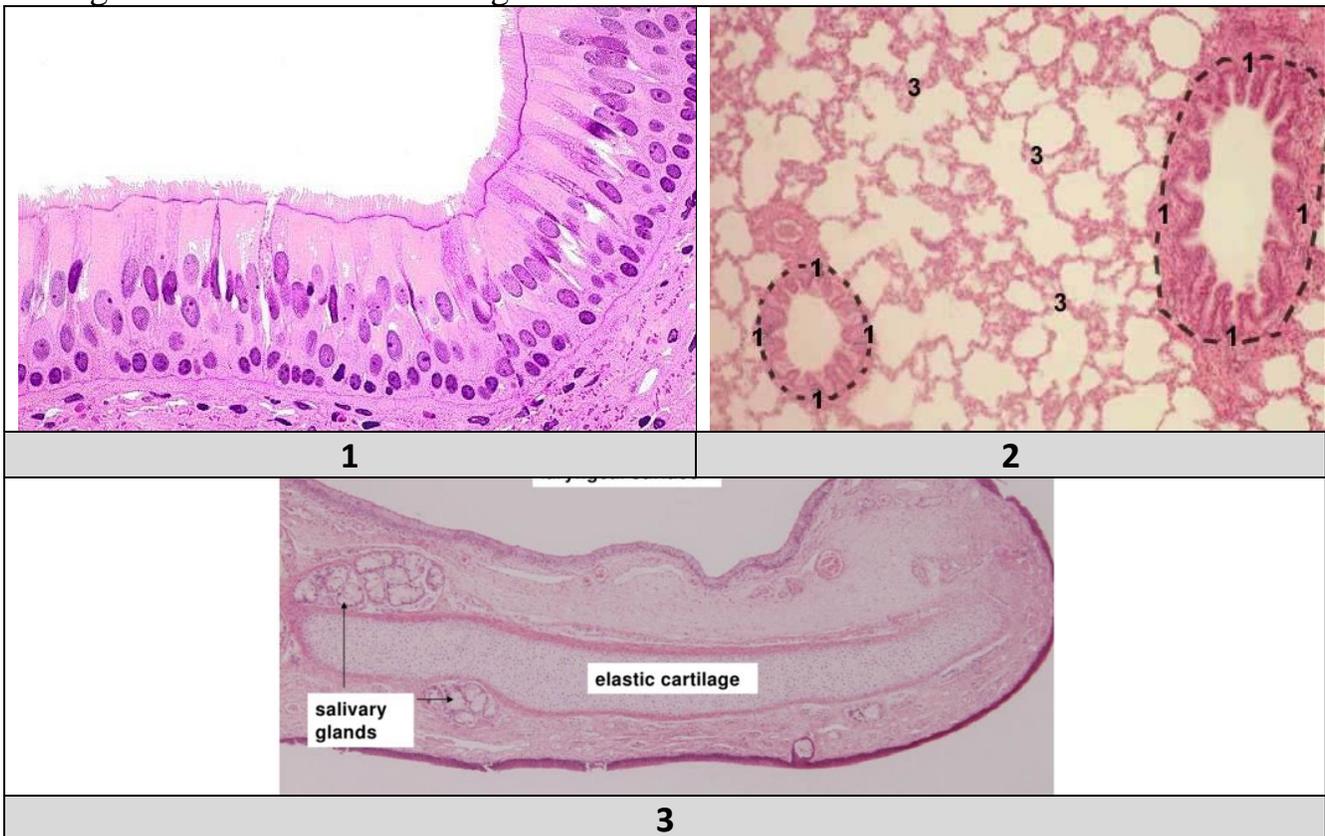
8. In a child of two years the evacuation of mucus from bronchi is disturbed. With violation of functions of which organelles of the cells of the bronchial epithelium can it be connected with?

- A Cilia
 C Cytoplasmic reticulum
- B Mitochondria
 D Microvilli
 E Lysosomes

9. As a result of trauma of a man's nose of 32 years of age. The mucus layer of superior nasal concha was damaged. What consequences did it result in?

- A Violation of smell sensation
 D Insufficient warming and moistening of air
- B Insufficient warming of air
 E Violation of cleaning of air

10. Sign the names of the histological slides



11. What type of cartilage forms the trachea?
 12. What cells make surfactant?
 13. How is the outer membrane that protects the lungs?
 14. Give an example of respiratory parts of the respiratory system
 15. Give an example of a conducting part of the respiratory system

TOPIC: URINARY SYSTEM

1. Examination of mountain climbers who have spent a long time in a high-altitude region revealed increase of erythrocyte number and haemoglobin concentration. What mechanism caused this phenomenon?

- A Intensified production of erythropoietin by the kidneys
- B Weakening of erythrocyte haemolysis in bloodstream
- C Improved ability of tissue for oxygen utilization
- D Intensified processes of anoxic energy production
- E Weakening of intracellular erythrocyte haemolysis

2. A microphotography represents a fragment of cortical substance of a kidney. This fragment contains thick spot cells and juxtaglomerular cells with big secretory granules. What kidney structure is represented?

- A Filtering barrier
- B Renal corpuscle
- C Juxtaglomerular apparatus
- D Prostaglandin apparatus
- E Choroid glomus

3. The low specific gravity of the secondary urine (1002) was found out in the sick person. What is the most distant part of nephron where concentration of secondary urine takes place?

- A In the nephron's glomerulus
- B In the collecting duct
- C In proximal tubule of nephron
- D In ascending part of loop of Henle
- E In distal tubule of nephron

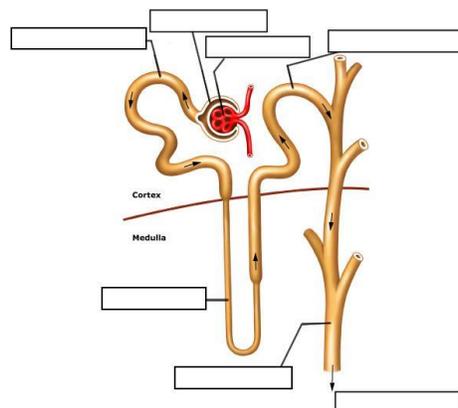
4. A histological specimen of kidney shows a structure consisting of a glomerulus of fenestrated capillaries and a bilayer epithelial capsule. Specify this structure:

- A Distal tubule
- B Proximal tubule
- C Renal corpuscle
- D Henle's loop
- E Receiving tube

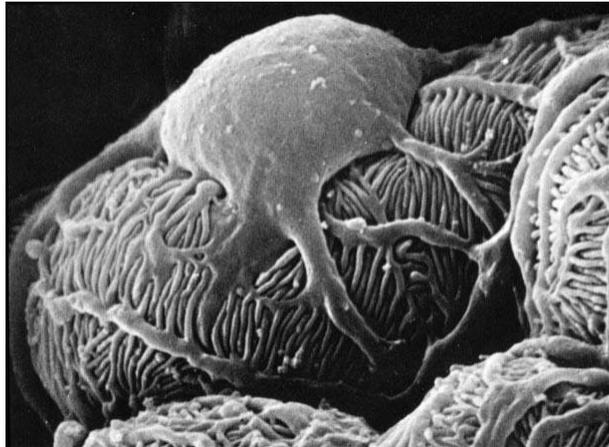
5. What are the 2 layers of the cross section of the kidney?

6. What are the structural and functional unit of the kidney?

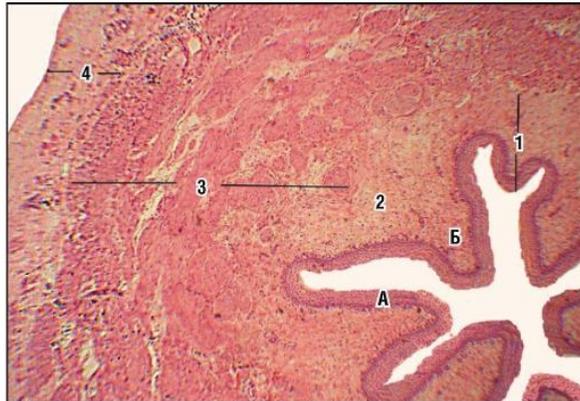
7. Name the structure in figure:



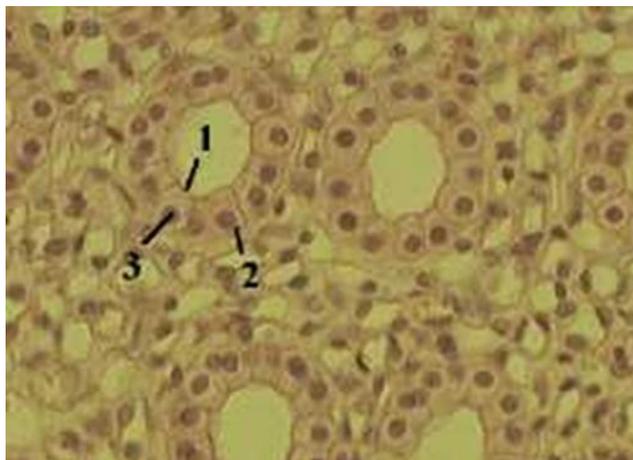
8. Name the structure, shown in figure



9. Name the histological layers of structure, that you see on photo, what type of tissues in all this layers?



10. Name type of tissues in structure, that you see on photo. What name of this structure?



TOPIC: DIGESTIVE SYSTEM

1. A patient was delivered to a hospital after having been exposed to ionizing radiation. He presents with vomiting, anorexia, pain in different region of abdomen, bloody feces, elevation of body temperature, inertness. Such clinical presentations are typical for the following form of acute radiation disease:

A Toxemic B Bone-marrow C Cerebral D Combined E Intestinal

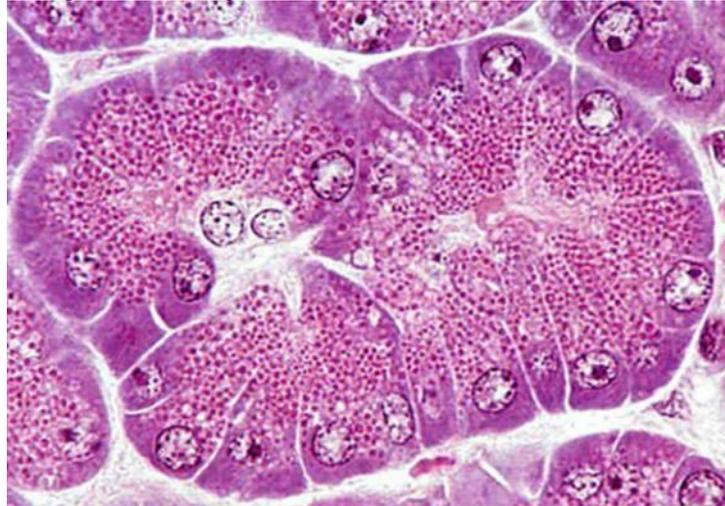
2. It was revealed that a patient with coagulation failure has thrombosis of a branch of inferior mesenteric artery. What bowel segment is affected?

A Colon sigmoideum B Ileum C Caecum D Colon transversum
E Colon ascendens

3. What types of salivary glands do you know?

4. What is the function of pepsine?

5. Name the gland, that you see in photo



6. A 2-year-old child has got intestinal dysbacteriosis, which results in hemorrhagic syndrome. What is the most likely cause of hemorrhage of the child? A Hypocalcemia

B Activation of tissue thromboplastin

C PP hypovitaminosis

D Fibrinogen deficiency

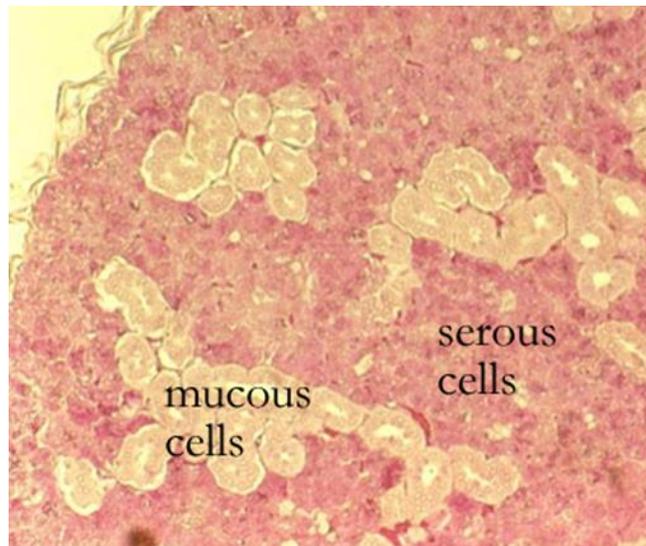
E Vitamin K insufficiency

7. On an histological specimen, a transverse section through the wall of hollow organ, the mucus envelope of which is covered by stratified squamous non-keratinized epithelium is seen. What organ is it? A Uterus B Duodenum C Colon D Esophagus E Appendix

8. What is the function of amylase?

9. What is the structural and functional unit of the liver?

10. Name the gland, that you see in photo



11. A histological specimen represents a structure of the oral cavity, which is formed by bone tissue. It is covered by mucous membrane consisting of keratinizing stratified squamous epithelium. The structure has fatty, glandular and marginal zone. In all parts of the lamina propria the collagen fibers form thick bundles that penetrate deep into the periosteum. What kind of structure is it?

A Hard palate B Gingiva C Lip D Cheek E Tongue

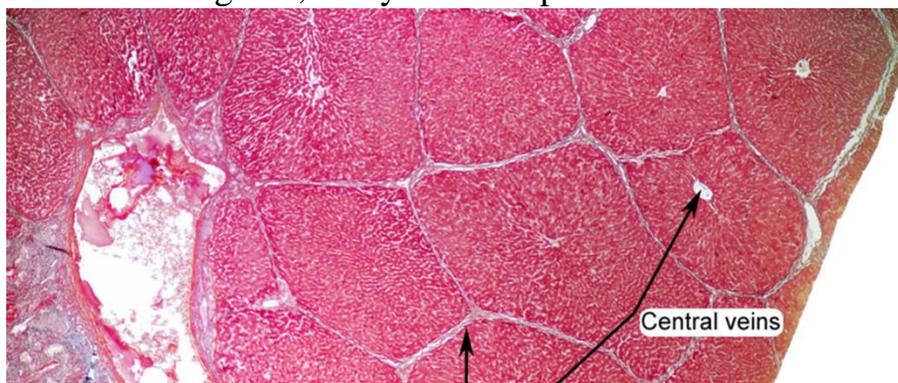
12. Histological study of an extirpated pulp revealed some cylindrical cells in its peripheral layer. What are these cells called? A Odontoblasts B Fibroblasts C Monocytes

D Ameloblasts E Myofibroblasts

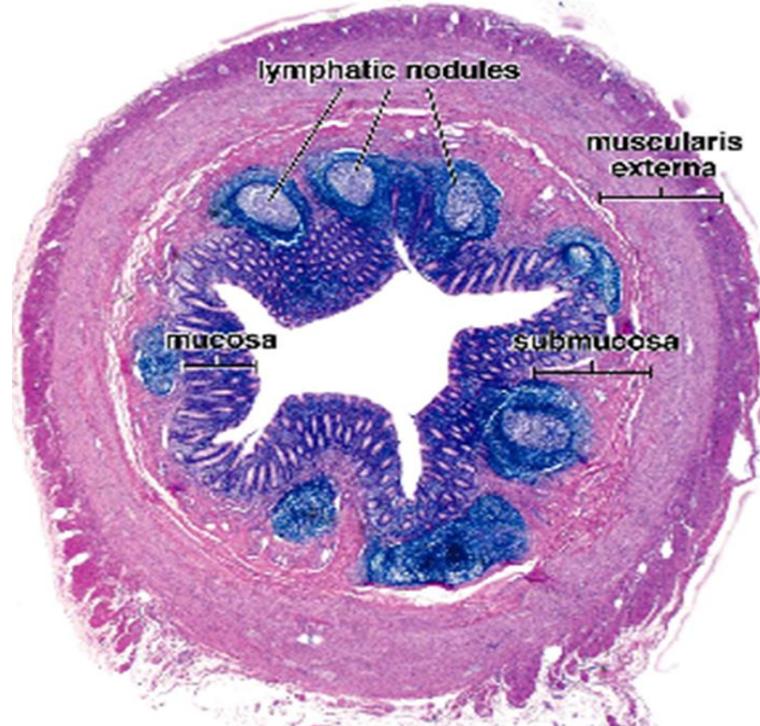
13. What type of glands forms a salivary gland?

14. What types of cells in the endocrine part of the pancreas did you know? What is their role?

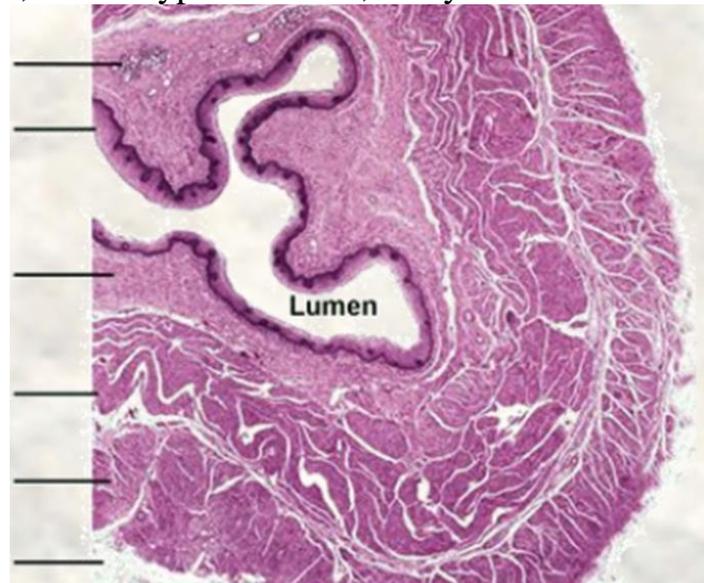
15. Name the gland, that you see in photo



16. What type of epithelium covers the surface of the tongue?
17. How many teeth on each jaw?
18. Name the bone material inside the tooth
19. What part of the divided small intestine?
20. Name the slide, and all type of tissues, that you know

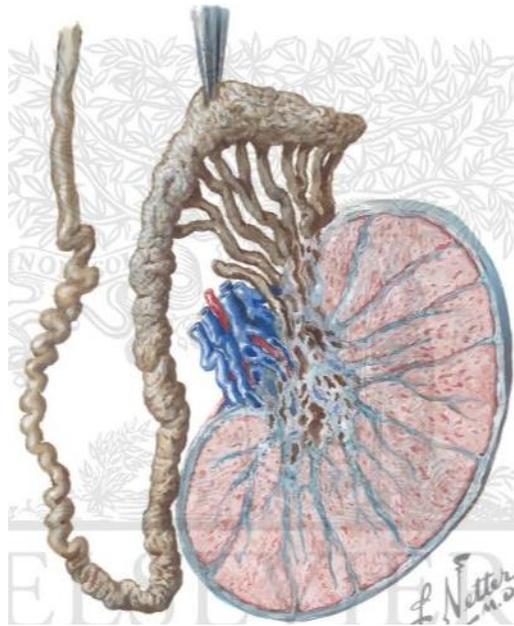


21. What type of tissue forms the taste buds?
22. What is the dental formula ?
23. What is covered tooth surface?
24. What part of the divided large intestine?
25. Name the slide, and all type of tissues, that you know

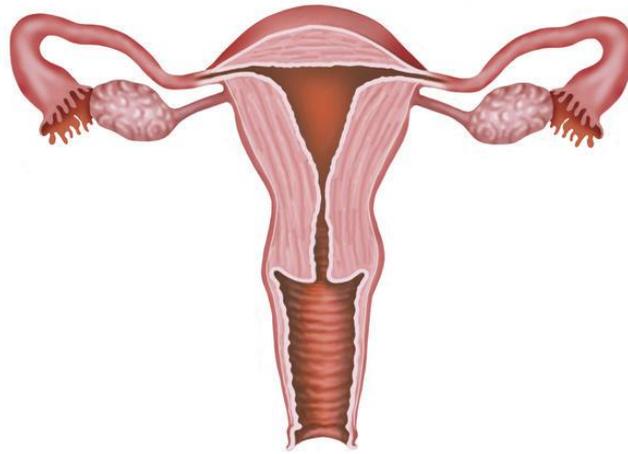


TOPIC: REPRODUCTIVE SYSTEM

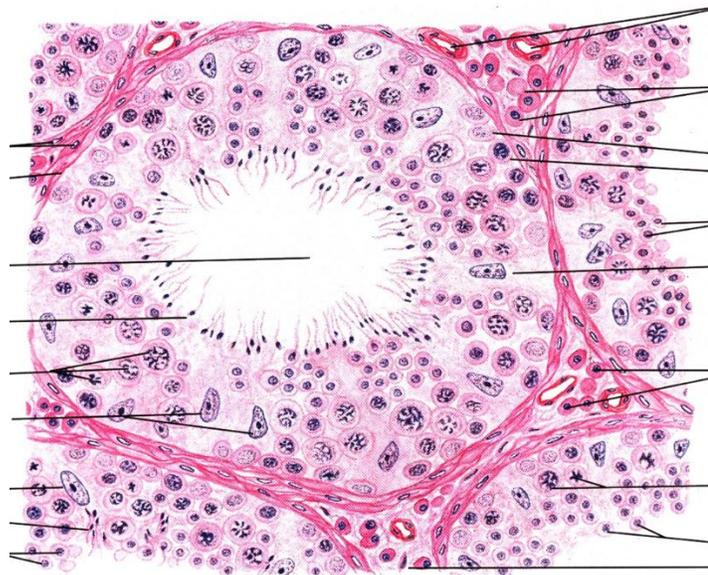
1. What name have male gonads?
2. What function of Sertoli cells?
3. What layers of tissues formed the wall of uterus?
4. What glands secrete clear mucus acting as a lubricant?
5. what is the structural and functional unit of male gonads?
6. What glands open into the urethra?
7. what is the process of release of eggs from the shell of the follicle?
8. What name has clusters of cells of mammary lobules?
9. Name the structure name which is shown in figure



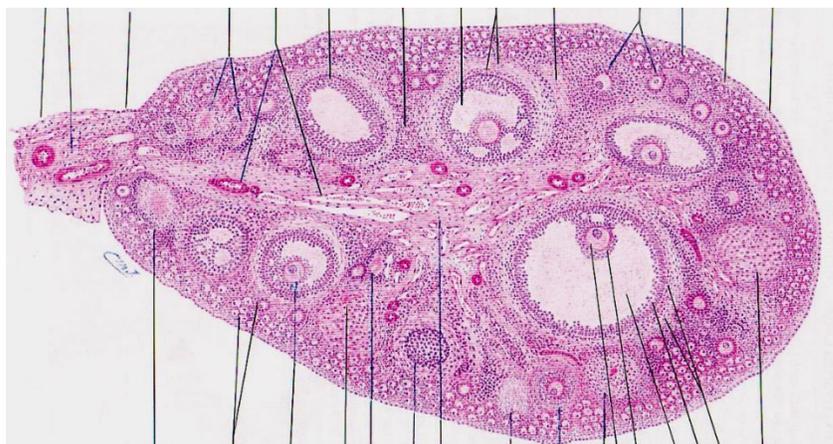
10. What name have female gonads?
11. What function of Leydig cells?
12. What layers of tissues formed the wall vas deferens?
13. What glands secrete glycoproteins & enzymes for expulsion during ejaculation?
14. What is the structural and functional unit of female gonads?
15. What name of the accessory glands associated with female reproductive tract?
16. What structure takes sperms away from the testes?
17. In what period of time the mammary glands are inactive become active?
18. Name the structure name which is shown by arrow in figure?



19. Name the structure name which is shown in figure



20. Name the structure name which is shown in figure



RECOMMENDED LIST OF SOURCES:

14. Гістологія, цитологія та ембріологія. Атлас = Histology, cytology and embryology = Гистология, цитология и эмбриология : навч. посіб. Для студ. вищ. навч. закл. - мед. ун-тів, ін-тів й акад. / О. Ю. Степаненко [та ін.] ; рец.: С. Б. Геращенко, В. І. Шепітько. Київ: ВСВ "Медицина", 2017. 152 с.
15. Практикум з цитології, ембріології та загальної гістології. Навчальний посібник/ Під ред. Е.Ф. Барінова, Ю.Б. Чайковського. Київ: ЦМК ВМО МОЗ України, 2000.
16. Чайковський Ю.Б., Дельцова О.І., Геращенко С.Б. Практикум з гістології, цитології та ембріології. Навчальний посібник. Київ – Івано-Франківськ, 2000.
17. Чайковський Ю.Б., Сокурєнко Л.М. Гістологія, цитологія та ембріологія. Атлас для самостійної роботи студентів. Луцьк, 2006. 152 с.
18. Kühnel W. Color Atlas of Cytology, Histology, and Microscopic Anatomy, 4th edition. Stuttgart: Georg Thieme Verlag; 2003. 534 p.
19. Leslie P. Gartner, James L. Hiatt. Color atlas and text of histology, Sixth Edition, 2014. 525 p.
20. Melnyk, N.O. Histology, cytology and embryology. K.: Book-plus, 2017. 416 p.
21. Ross, M.H. Pawlina W. Histology: a Text and Atlas with Correlated Cell and Molecular Biology. 7-th ed. Philadelphia : Wolters Kluwer, 2016. 984 p.
22. Ross, M.H. Pawlina W. Histology: a Text and Atlas with Correlated Cell and Molecular Biology. 6-th ed. Philadelphia : Wolters Kluwer, 2010. 974 p.

INTERNET SOURCES:

1. https://semmelweis.hu/anatomia/files/2020/02/20200211Kocsis_alapszovetek_bor.pdf
2. https://essuir.sumdu.edu.ua/bitstream-download/123456789/76739/1/Hryntsova_tsytolohiia_atlas.pdf;jsessionid=4A4ACCC50C43CBE7E5BB130FCF81A4FB
3. <https://studfile.net/preview/5943797/>
4. <http://histology.medicine.umich.edu/>
5. <http://histologyatlas.wisc.edu/>
6. <http://intranet.tdmu.edu.ua/data/kafedra/internal/histolog.../>
7. <http://library.med.utah.edu/WebPath/HISTHTML/HISTO.html>
8. <http://synapses.clm.utexas.edu/atlas/contents.stm>

RECOMMENDED LIST OF SOURCES:

1. Барінов ЕФ, Чайковський ЮБ. Спеціальна гістологія та ембріологія внутрішніх органів: навчальний посібник. Київ: Медицина; 2013. 471 с.
2. Барінов ЕФ, Чайковський ЮБ. Цитологія і загальна ембріологія: навчальний посібник. Київ: Медицина; 2010. 216 с.
3. Волков К.С., Пасечко Н.В. Ультраструктура клітин і тканин. Атлас. Тернопіль. Укрмедкнига, 1997. 93 с.
4. Гістологічна термінологія. Міжнародні терміни з цитології та гістології людини / Федеративний міжнародний комітет з анатомічної термінології: переклад з англ. Вид. за ред. Ю.Б. Чайковського, О.Д. Луцика. К.: Медицина, 2010. 304 с.
5. Гістологія людини: підруч. для студ. вищ. мед. навч. закл. III-IV рівнів акредитації / О. Д. Луцик [та ін.]. Вид. 4-те доопрац. та випр. Київ : Книга-плюс, 2013. 584 с.
6. Гістологія людини: підручник / [Луцик О.Д., Іванова А.Й., Кабак К.С., Чайковський Ю.Б.]. К.: Книга плюс, 2010. 584 с.
7. Гістологія, цитологія та ембріологія. Атлас = Histology, cytology and embryology = Гистология, цитология и эмбриология : навч. посіб. Для студ. вищ. навч. закл. - мед. ун-тів, ін-тів й акад. / О. Ю. Степаненко [та ін.] ; рец.: С. Б. Геращенко, В. І. Шепітько. Київ: ВСВ "Медицина", 2017. 152 с.
8. Гістологія. Короткий курс : навч. посіб. для самостійної підготов. До практ. занять, підсумкових модулів та іспиту "Крок-1" / Г. І . Козак [та ін.] ; за ред.: Ю.Б. Чайковського ; рец.: О. Д. Луцик, М. С. Пушкар ; МОЗ України, Нац. мед. ун-т ім. О. О. Богомольца. Вінниця: Нова книга, 2016. 336 с.
9. Гістологія. Цитологія. Ембріологія : підруч. для студентів / за ред. : О. Д. Луцика, Ю. Б. Чайковського. Вінниця : Нова Кн., 2018. 496 с.
10. Гістологія. Цитологія. Ембріологія : підручник для студ. стомат. ф-ту. / Луцик О.Д., Чайковський Ю.Б. (за ред.). Вінниця : Нова Книга, 2020. 496 с.
11. Дельцова О.І., Чайковський Ю.Б., Геращенко С.Б. Гістологія та ембріогенез органів ротової порожнини: навчальний посібник. Івано-Франківськ; 1998. 78 с.
12. Луцик О.Д. Гістологія. Цитологія. Ембріологія. Підручник. Вінниця «Нова книга», 2018. 592 с.
13. Медична ембріологія з основами тератології: навчальний посібник. Під ред. Чайковського. Вінниця: Нова Книга; 2019. 206 с.
14. Новак В.П., Мельниченко А.П. Цитологія, гістологія, ембріологія: навчальний посібник. Біла Церква, 2005. 256 с.
15. Патоморфологія та гістологія: атлас [гістологія, патоморфологія, цитоморфологія] / Д. Д. Зербіно, М. М. Багрій, Я. Я. Боднар, В. А. Діброва.— Вінниця: Нова Книга, 2016. 800 с.

16. Практикум зі спеціальної гістології: Навч. посібник / За ред. К.Ф. Барінова, Ю.Б. Чайковського. К.: Здоров'я, 2000.
17. Чайковський Ю.Б., Дельцова О.І., Геращенко С.Б. Практикум з гістології, цитології та ембріології. Навчальний посібник. Київ – Івано-Франківськ, 2000.
18. Практикум з цитології, ембріології та загальної гістології. Навчальний посібник/ Під ред. Е.Ф. Барінова, Ю.Б. Чайковського. Київ: ЦМК ВМО МОЗ України, 2000.
19. Садлер Т.В. Медична ембріологія за Лангманом. Львів, „Наутілус”, 2001. 550с.
20. Спеціальна гістологія і ембріологія внутрішніх органів. Навчальний посібник. Під ред. Е.Ф. Барінова, Ю.Б. Чайковського. Київ, ВСВ «Медицина», 2013. 471 с.
21. Трускавецький Є.С. Гістологія з основами ембріології: підручник / Є.Трускавецький, Р.Мельниченко К.: Вища шк., 2005. 327 с.
22. Цитологія (атлас для самостійної роботи студентів) : навч. посіб. / Н. Б. Гринцова, Л. І. Кіптенко, М. М. Дунаєва та ін.; за заг. ред. В. І. Бумейстер. Суми : СумДУ, 2020. 65 с.
23. Цитологія: Підручник. Трускавецький Є.С. К.: Вища школа, 2004. 254 с.
24. Цитологія і загальна ембріологія. Навчальний посібник. Під ред. Е.Ф. Барінова, Ю.Б. Чайковського. Київ, ВСВ «Медицина», 2010. 216 с.
25. Чайковський Ю.Б., Сокурєнко Л.М. Гістологія, цитологія та ембріологія. Атлас для самостійної роботи студентів. Луцьк, 2006. 152 с.
26. Яременко Л.М., Божко О.Г., Грабовий О.М., Чайковський Ю.Б. Компедіум з цитології, загальної ембріології та гістології. Київ: Книга-плюс. 2020. 144 с.
27. Andrew P. Wickens. A History of the Brain: From Stone Age Surgery to Modern Neuroscience // — London : Psychology Press, 2014. — 404 p.
28. David, H. Cormack Essential Histology. Lippincott Williams & Wilkins, 2001.
29. Eroschenko, V.P. Atlas of Histology with Functional Correlations. Thirteenth edition. Philadelphia: Wolters Kluwer, 2017. 617 p
30. Gartner, L. P. Hiatt: Color Atlas and Text of Histology. 6th Ed. Wolters Kluwer business, Lippincott Williams & Wilkins, 2014.
31. Kierszenbaum A.L., Tres L.L. Histology and Cell Biology. Elsevier, Philadelphia, 2012. 701 p.
32. Kühnel W. Color Atlas of Cytology, Histology, and Microscopic Anatomy, 4th edition. Stuttgart: Georg Thieme Verlag; 2003. 534 p.
33. Leslie P. Gartner, James L. Hiatt. Color atlas and text of histology, Sixth Edition, 2014. 525 p.
34. Melnyk, N.O. Histology, cytology and embryology. K.: Book-plus, 2017. 416 p.

35. Melnyk, N.O. Histology, cytology and embryology (short course). K.: Book-plus, 2018. 312 p.
36. Melnyk, N.O. Histology, cytology, embryology. Practical guide. K.: Book-plus, 2018. 43 p.
37. Ross M.H., Pawlina W. Histology. A Text and Atlas. Wolters Kluwer, Philadelphia, 2011. 974p
38. Ross, M.H. Pawlina W. Histology : a Text and Atlas with Correlated Cell and Molecular Biology. 7-th ed. Philadelphia : Wolters Kluwer, 2016. 984 p.
39. Scott, F. G. Developmental Biology. 9th Ed. Pal- grave, 2013.
40. Wilson, J. Hunt T. Molecular Biology of the Cell, Fifth Edition. The Problems Book. 5th Ed. Garland Science, 2008.

INTERNET SOURCES:

1. <https://medical-enc.com.ua/electron-microscopy.htm>
2. <https://docplayer.net/147762336-Posibnik-dlya-pidgotovki-do-praktichnih-zanyat-ta-licenciynogo-ispitu-krok-1-z-gistologiyi-citologiyi-ta-embriologiyi.html>
3. <http://astro.temple.edu/~sodicm/labs/index.htm>
4. <http://biodidac.bio.uottawa.ca/thumbnails/histocatquery.htm>
5. <http://education.denniskunkel.com/>
6. <http://education.med.nyu.edu/virtualmicroscope/collection/23/>
7. <http://histology.medicine.umich.edu/>
8. <http://histology.medicine.umich.edu/>
9. <http://histologyatlas.wisc.edu/>
10. <http://intranet.tdmu.edu.ua/data/kafedra/internal/histolog.../>
11. <http://library.med.utah.edu/WebPath/HISTHTML/HISTO.html>
12. <http://synapses.clm.utexas.edu/atlas/contents.stm>
13. <http://www.bu.edu/histology/m/index.htm>
14. <http://www.deltagen.com/target/histologyatlas/HistologyAtlas.html>
15. http://www.dermathmd.com/Case%20Studies/case_studies_archives.htm
16. <http://www.healthcare.uiowa.edu/anatomy/dental/oralhist/>
17. http://www.histology.be/digital_microscope_histology_.html
18. <http://www.kumc.edu/instruction/medicine/anatomy/histoweb/>
19. <http://www.lab.anhb.uwa.edu.au/mb140/>
20. http://www.meddean.luc.edu/lumen/MedEd/Histo/frames/histo_frames.html
21. <http://www.micron.uerj.br/atlas/atlasenglish/Menu.htm>
22. <http://www.path.uiowa.edu/virtualslidebox/>
23. <http://www.pathguy.com/histo/000.htm>
24. <http://www.siumed.edu/~dking2/>
25. <http://www.udel.edu/biology/Wags/histopage/histopage.htm>
26. <http://microanatomy.net/>

27. <http://ru.scribd.com/doc/129890705/A-Short-Tale-on-Histology-History-docx>
28. https://semmelweis.hu/anatomia/files/2020/02/20200211Kocsis_alapszovetek_bor.pdf
29. https://essuir.sumdu.edu.ua/bitstream-download/123456789/76739/1/Hryntsova_tsytolohiia_atlas.pdf;jsessionid=4A4ACCC50C43CBE7E5BB130FCF81A4FB
30. <https://uk.wikipedia.org/wiki/%D0%9C%D1%96%D1%82%D0%BE%D1%85%D0%BE%D0%BD%D0%B4%D1%80%D1%96%D1%8F>
31. <https://www.google.com/url?sa=i&url=https%3A%2F%2Fvseosvita.ua%2Ftest%2Flaboratorne-doslidzhennia-2-fazy-mitozu-1793811.html&psig=AOvVaw1u7YbDmDXYtgLD1ENEY25W&ust=1677307861093000&source=images&cd=vfe&ved=2ahUKEwjO0JfryK39AhWIPOwKHTPQAbYQr4kDegUIARC6AQ>
32. <https://www.google.com/url?sa=i&url=https%3A%2F%2Fuk.wikipedia.org%2Fwiki%2F%25D0%259C%25D1%2596%25D1%2582%25D0%25BE%25D0%25B7&psig=AOvVaw0RfUHx9WHhi16fZIdWbiLE&ust=1677310730176000&source=images&cd=vfe&ved=0CBAQjRxqFwoTCNiHy8PTrf0CFQAAAAAdAAAAABAF>
33. https://www.google.com/url?sa=i&url=https%3A%2F%2Fstudref.com%2F437054%2Fagropromyshlennost%2Fzaschitnye_mehanizmy_organizma&psig=AOvVaw1CUNMiInk6bTHMaq8rJULg&ust=1677309697120000&source=images&cd=vfe&ved=0CBEQjhxqFwoTCNip_tPrf0CFQAAAAAdAAAAABAJ
34. <http://ibib.ltd.ua/znachennya-hromosomnoyi-organizatsiyi-u-funktsionuvanni-ta-spadkuvanni-genetichnogo.html>
35. https://zno.osvita.ua/biology/tag-zberezhennja_spadkovoyi_informaciyi/
36. <https://www.google.com/url?sa=i&url=https%3A%2F%2Fstudfile.net%2Fpreview%2F3540809%2Fpage%3A6%2F&psig=AOvVaw0YsIG7eflrLSwVDpNoMEyM&ust=1677307590874000&source=images&cd=vfe&ved=2ahUKEwi54arqx639AhVDwwIHHSm6DKkQr4kDegQIARBV>
37. https://www.google.com/url?sa=i&url=http%3A%2F%2Fwww.irbis-nbu.gov.ua%2Fcgi-bin%2Firis_nbu%2Fcgiiiris_64.exe%3FC21COM%3D2%26I21DBN%3DUJRN%26P21DBN%3DUJRN%26IMAGE_FILE_DOWNLOAD%3D1%26Image_file_name%3DPDF%2FS_med_2013_4%252842%2529_35.pdf&psig=AOvVaw2diVEqkoo3jwB3d11D31Gc&ust=1677307154428000&source=images&cd=vfe&ved=2ahUKEwivopyaxq39AhVpxQIHUItDl0Qr4kDegQIARBP
38. https://www.google.com/url?sa=i&url=https%3A%2F%2Fmozok.click%2F1318-citoplazma-y-osnovn-klinn-organeli.html&psig=AOvVaw0Orc4mJJ_k6EBtQgcudd3&ust=1677304900962000&source=images&cd=vfe&ved=2ahUKEwilx9fnva39AhWLYaQKHeLjDiQQr4kDegUIARDFAQ

**METHODOLOGICAL RECOMMENDATIONS
TO INDEPENDENT WORK ON THE CYTOLOGICAL BASIS OF HUMAN
ONTOGENESIS**

for students of the second (master's) level of higher education in the specialty
014 Secondary education (Chemistry)
subject specialty: 014.06 Secondary education (Chemistry)
combined subject specialty: 014.05 Secondary education (Biology and human health)
educational and professional program: Secondary education
(Chemistry, Biology and human health)
full-time and part-time (distance) forms of education

Mariia Serhiivna Bobrova

**CERTIFICATE ON SUBJECT SUBJECT PUBLISHING
CASES TO THE STATE REGISTER OF PUBLISHERS,
MANUFACTURERS AND DISTRIBUTORS
PUBLISHING PRODUCTS**

Series DK No. 1537 dated 10/22/2003.

Signed for printing 14.05.2024 (protocol 4) Format 60x90/16. Offset paper.
Print risograph. 3.19 con.prin.sh. 3,17 Circulation 100

EDITORIAL AND PUBLISHING DEPARTMENT
Volodymyr Vynnychenko Central Ukrainian State University
25006, Kropyvnytskyi, Shevchenka St., 1.
Tel. (0522) 24-59-84.
Fax (0522) 248544.
E-mail: mails@cuspu.edu.ua