



*PROTOCOLS
FOR PRACTICAL CLASSES
ON HISTOLOGY, CYTOLOGY AND
EMBRYOLOGY*

Date « _____ » _____ **202_ year**

Content module 1 _____
(підпис викладача)

Date « _____ » _____ **202_ year**

Content module 2 _____
(підпис викладача)

Date « _____ » _____ **202_ year**

Final module I _____
(підпис викладача)

Date « _____ » _____ **202_ year**

Content module 3 _____
(підпис викладача)

Date « _____ » _____ **202_ year**

Content module 4 _____
(підпис викладача)

Date « _____ » _____ **202_ year**

Content module 5 _____
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Date « _____ » _____ **202_ year**

Final module II _____

THE MINISTRY OF HEALTH OF UKRAINE

***Bukovinian State Medical University
Department of Histology, Cytology and Embryology***

Protocols for practical classes on Histology, Cytology and Embryology

Student_____

Group_____ ***Course***_____

Speciality_____

Faculty_____

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During practical classes on Histology, Cytology and Embryology students spend substantial time diagnosing histologic specimens by means of a light microscope and studying microscopic structure of the morphologic objects.

Practical work includes sketching in protocols the main structural components of the cells, tissues and organs that makes the process of students' self-training easier and promotes deep learning of certain structures on histologic specimens.

The protocols improve activation of students' work concerning the analysis of structural and functional peculiarities of the level of their medical training the following successful mastering clinical subjects.

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MODULE I CYTOLOGY. MEDICAL EMBRYOLOGY AND GENERAL HISTOLOGY

CONTENT MODULE 1 CYTOLOGY AND MEDICAL EMBRYOLOGY

PRACTICAL CLASS № 1

THEME: Preparation of tissues for microscopic examination. Methods of the microscopic investigations

MAIN STEPS TO PREPARE THE HISTOLOGIC SPECIMENS

1. **Taking the material** (volume of the taken material 0,5-1 cm³).
2. **Fixation of the material.** *Aim of the fixation:* conservation of the tissue structure. *Fixatives:* simple – formalin, alcohol, sulema; compound – liquid of Buena, liquid of Kearney. *Duration of the fixation:* depends on type of the fixative, volume of the taken material.
3. **Irrigation of the material** (method and duration depend on the method of fixation).
4. **Dehydration and densification of the material.** Is performed by means of ethanol of increased concentration (from 50 to 100°). Duration of staying in each of the alcohol solution is twenty-four hours.
5. **Embedding the material into the dense medium.**
Dense media: paraffin, celloidin, paraffin-celloidin, gelatin.

Paraffin embedding:

- immersion of pieces through the mixture of alcohol and xylol;
- immersion of pieces through xylol;
- immersion of the material in the mixture of xylol and paraffin;
- immersion of the material into liquid paraffin (melting temperature 55-56°).

Celloidin embedding:

- immersion of the material in the mixture of absolute alcohol and ether (4-20 hours);
- immersion of the material through 2% liquid celloidin (2-6 days);

- immersion of the material through 4-6% liquid celloidin (2-6 days);
- immersion of the material through 8-10% thick celloidin (2-6 days);
- immersion of the material by 10% fresh celloidin into the Petri dish;
- densification in chloroform vapour in the exicator.

6. **Preparing of the sections.** The hard blocks containing the tissues are taken and sectioned by the microtome. To receive sections quickly (express-histological diagnostics) freezing is used.

7. **Staining of sections.** Is made to detect microstructures of cells and tissues. Before staining deparaffination of the sections in organic solvents is made (xylol, toluol), and later – through ethanol of decreased concentration (from 100° to 50°). During staining more often several histological dyes are used.

Histological dyes:

- *basic dyes (nucleic)* – hematoxylin, tionin, methyl green;
- *acidic dyes (cytoplasmic)* – eosin, fuchsin, kongo red;
- *neutral* – resorcin-fuchsin, acid eosin, methylene blue;
- *special* – nitric-acid silver, orcein, sudan III.

8. **Enclosing of the sections.** Before of enclosing the sections it is necessary to dehydrate them in ethanol of increased concentration. Then sections are disinfected in carbol-xylol (1:1), xylol and enclosed in balsam and covered by a cover glass.

INSTRUCTIONS OF THE USE WITH A LIGHT MICROSCOPE

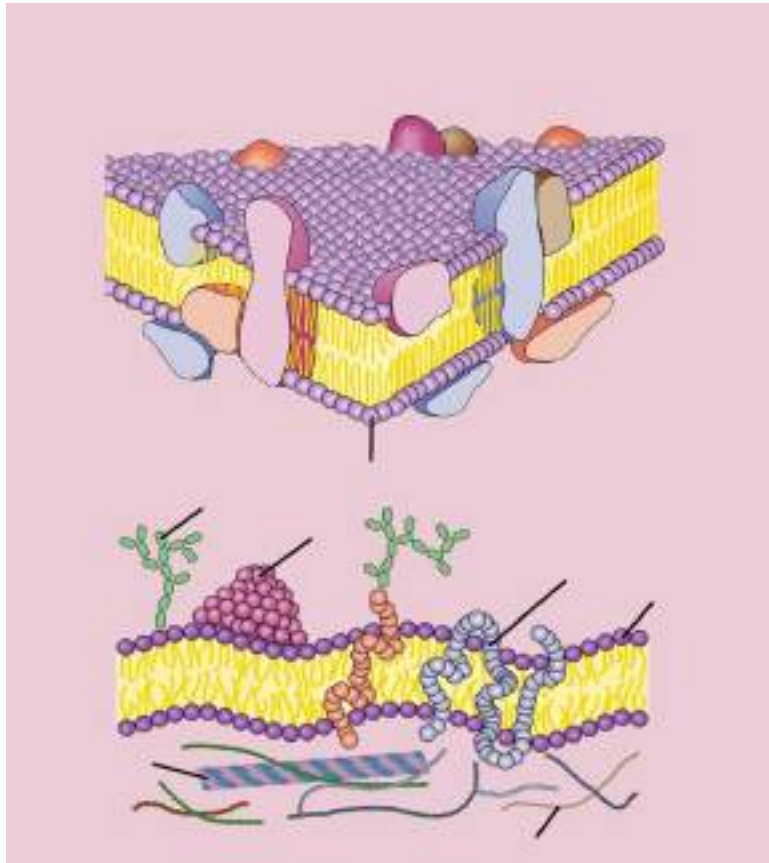
- 1. Place the microscope properly in a working position.*
- 2. Fix the objective of a low magnification opposite to the objective stage opening at the distance of 1,5 cm.*
- 3. Light up the visual field by means of a microscope glass.*
- 4. Put a specimen on the objective stage with a cover glass up. Place a section opposite to the microscope frontal lens.*
- 5. Looking from aside, lower the microscope tubus down, leaving a minimal space between the objective and the specimen (up to 1 cm).*
- 6. Looking into the eye-piece lift up the tubus slowly by means of a macroscrew until the appearance of the object being observed.*
- 7. Examine the whole specimen while observing it under a low magnification.*
- 8. Choose the most peculiar portion while examining the specimen under a high magnification. Objective change takes place in the following way: without lifting the tubus turn the revolver and place the microscope objective of a high magnification on the microscope optical axis.*
- 9. Looking into the eye-piece lift up the tubus slowly by means of a microscrow until the appearance of image.*
- 10. On completion of work raise the tubus by turning the macroscrew, remove the specimen from the objective stage.*

PRACTICAL CLASS № 2



THEME: Cytology. Cell, its structure and functions. Plasmalemma

Diagram №1. Structure of the biological and cell membranes



- I. Glycocalyx (cell coat):** 1.Carbohydrates;
II. Lipid bilayer: 2.Lipid molecule; 3.Integral proteins; 4. Semi-integral proteins; 5. Peripheral proteins;
III. Submembrane cortical layer: 6.Actin microfilaments; 7.Microtubules

Diagram №2. Ultramicroscopic structure of the cell



- 1.Plasmalemma; 2.Cytoplasm: a)smooth endoplasmic reticulum; b)rough endoplasmic reticulum; c)ribosome; d)Golgi apparatus; e)mitochondrion; f)lysosome; g)cell center; 3.Nucleus

PRACTICAL CLASS № 3



THEME: Cytoplasm: general organelles, specialized organelles. Inclusions

Specimen №1. Golgi complex in the neurons
(spinal ganglion)

Stained with: osmic impregnation

1.Plasmalemma; 2.Cytoplasm; 3.Nucleus; 4.Golgi complex

Specimen №2. Neurofibrils in the cytoplasm of the multipolar
neurons of the spinal cord

Stained with: silver impregnation

1.Neuron; 2.Cytoplasm; 3.Nucleus; 4.Processes; 5.Neurofibrils

Specimen №3. Glycogen inclusions in hepatocytes
Stained with: SHIK – reaction

1.Nucleus; 2.Cytoplasm; 3.Glycogen granules

Specimen №4. Lipid inclusions in hepatocytes
Stained with: osmic acid

1.Cytoplasm; 2.Nucleus; 3.Lipid inclusions

PRACTICAL CLASS № 4



THEME: *Nucleus of the cell. Cell cycle. Mitosis. Differentiation. Aging and death of the cells*

Specimen №1. Karyokinesis of the plant cells

Stained with: iron haematoxylin

A.Interphase: 1.Plasmalemma; 2.Cytoplasm; 3.Nucleus; 4.Nucleolus;

B.Mitosis: *I.Prophase:* 1.Early prophase: a)chromosomes; 2.Late prophase;

II.Metaphase: 1.Metaphase plate (maternal star); 2.Spindle fibers; 3.Centrioles;

III.Anaphase: 1.Spindle fibers; 2.Chromosomes; 3.Centrioles; *IV.Telophase:* 1.Early telophase: a)invagination of the plasmalemma; b)chromosomes; c)future daughter cells; 2.Late telophase: a)daughter cells

PRACTICAL CLASS № 5

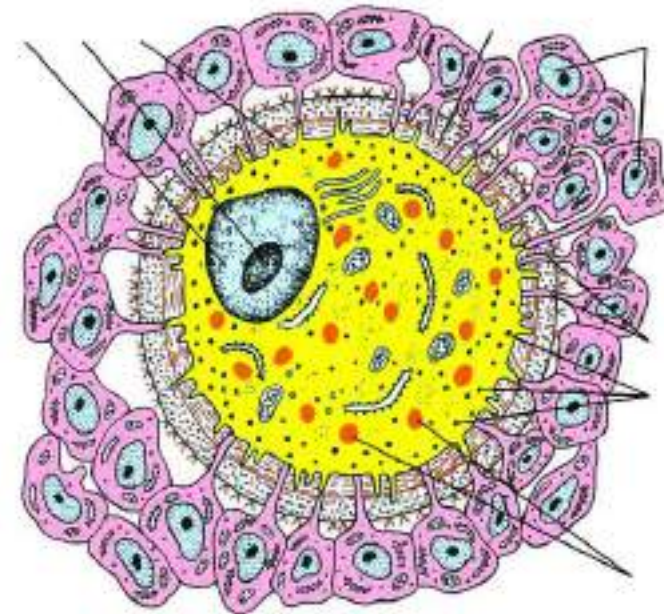


THEME: Meiosis and the difference from mitosis. Structure of sex cells

Specimen №1. Oocyte of mature follicle
(cat ovary)

Stained with: haematoxylin and eosin

Diagram №1. General structure of the ovum



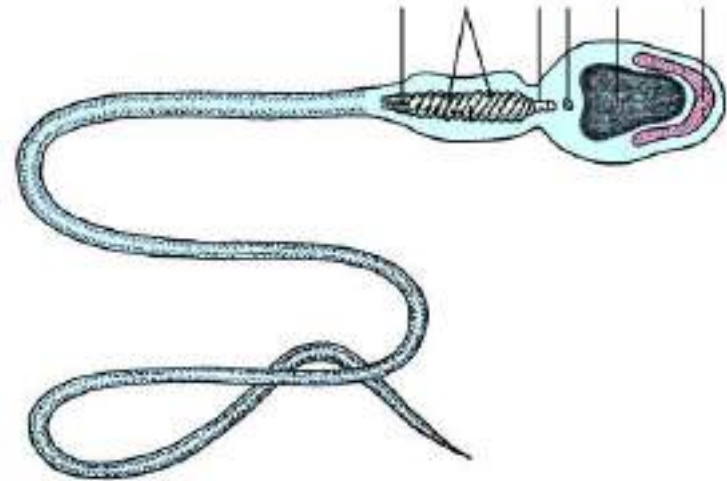
1.Tertiary follicle 2.Cumulus oophorus; 3.Oocyte;

1.Nucleus; 2.Nucleoli; 3.Ovolemme; 4.Zona pellucida:
a)receptors; 5.Corona radiata: a)follicular cells; 6.Cortical
granules; 7.Yolk inclusions

Specimen №2. Smear of the male spermatozoa
Stained with: nigrosin and eosin

1.Spermatozoa: a) head; b) tail

Diagram №2. Structure of the human spermatozoon



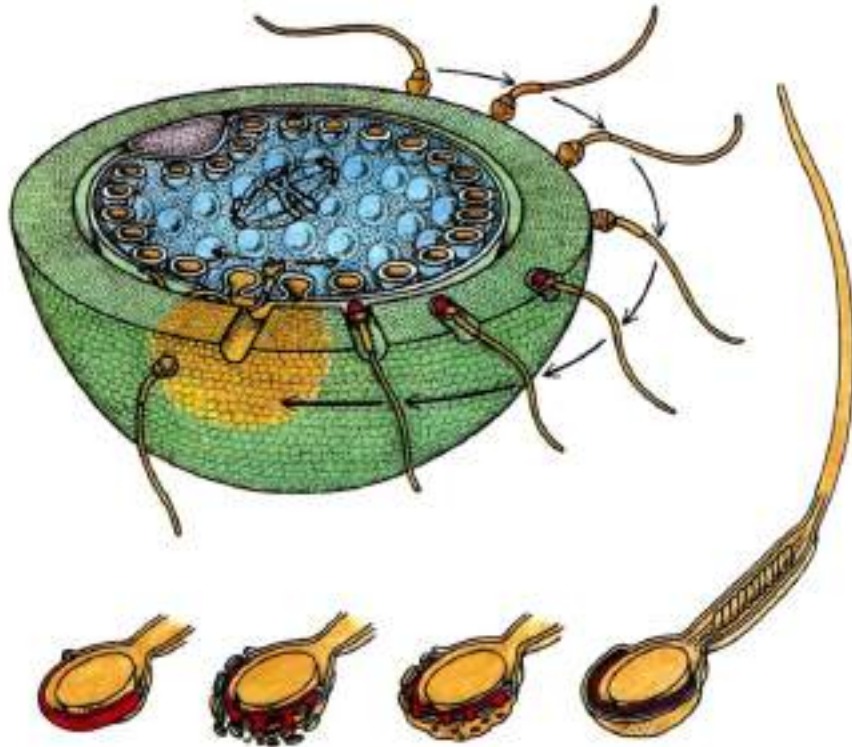
I.Head: 1.Nucleus; 2.Acrosome;
II.Neck: 3.Proximal centriole; 4.Distal centriole;
III.Tail: 5.Mitochondria; 6.Axial thread of the tail

PRACTICAL CLASS № 6



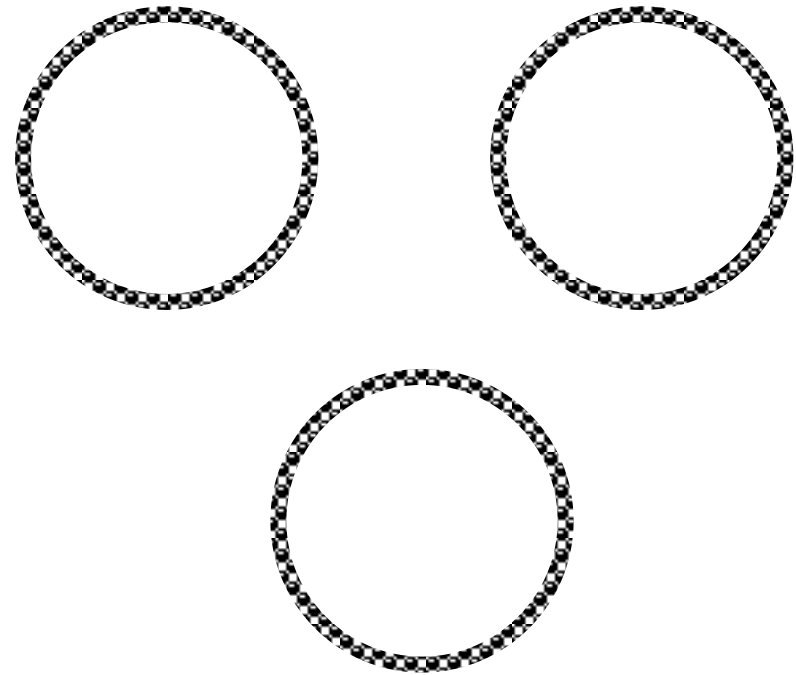
THEME: Medical embryology. Fertilization. Cleavage

Diagram №1. Fertilization



1,2,3,4. Acrosomal reaction; 5. Zona pellucida; 6. Oolemma;
7. Cortical granules; 8. Cortical reaction

Diagram №2. Cleavage



I. Three-cell stage: 1. Light blastomere; 2. Dark blastomeres

II. Morula: 3. Group of blastomeres: light (a) and dark (b);

III. Blastocyst: 4. Embryoblast; 5. Trophoblast; 6. Blastocyst cavity

PRACTICAL CLASS № 7



THEME: Implantation. Gastrulation

Specimen №1. Embryo at the primitive streak stage
Stained with: iron haematoxylin

1.Epiblast – ectodermal germ layer; 2.Primitive streak;
 3.Material of the primitive streak; 4.Hypoblast – endodermal
 germ layer; 5.Mesoderm

Diagram №1. Embryo implantation into the uterine mucosa
 (7-th day of the human embryo development)



I.Fallopian tube;

II.Tunica mucosa of the uterus: 1.Endometrial epithelium;
 2.Endometrial stroma; 3.Uterine glands; 4.Blastocyst; 5.Zona of
 fertilization; 6.Differentiated trophoblast: a)cytotrophoblast;
 b)syncytiotrophoblast;

III.Implantation



Specimen №1. Embryo at the stage of neural tube, somites and notochord formation

Specimen №2. Chicken embryo at the stage of the trunk and amniotic folds

1.Ectoderm; 2.Endoderm; 3.Derivatives of the mesodermal germ layer: a)somites; b)intermediate mesoderm; c)parietal mesoderm layer; d)visceral mesoderm layer; 4.Coelom; 5.Notochord; 6.Neural tube

1.Embryonic ectoderm; 2.Embryonic endoderm; 3.Dermatome;
4.Primary renal canaliculi; 5.Parietal mesoderm layer; 6.Visceral
mesoderm layer; 7.Coelom; 8.Neural tube; 9.Notochord; 10.Dorsal
aorta; 11.Trunk folds; 12.Amniotic folds

Specimen №3. Umbilical cord

Stained with: haematoxylin and eosin

1.Epithelium of amnion; 2.Mucous connective tissue; 3.Vein; 4.Arteries

Specimen №4. Human placenta
Stained with: haematoxylin and eosin

FETAL PLACENTA

MATERNAL PLACENTA

1.Epithelium of amnion; 2.Chorionic plate; 3.Chorionic villi:
a)cytotrophoblast; b)syncytiotrophoblast; c)stroma; d)blood
vessels; 4.Lacunae with maternal blood

1.Decidua basalis: a)decidual cells; b)connective tissue;
2.Myometrium

PRACTICAL CLASS № 9



THEME: Control of the content module 1

List of the specimens, which are necessary to identify during the control of module 1

1. Golgi complex in the neurons of the spinal cord. Osmic impregnation
2. Neurofibrills in the cytoplasm of nervous cell. Silver impregnation
3. Inclusions of glycogen in hepatocytes. PAS – reaction
4. Lipid inclusions. Sudan black, safranin
5. Mitosis of the plant cell. Iron haematoxylin
6. Oocyte. Haematoxylin and eosin
7. Spermatozoa of guinea pig. Nigrozin and eosin
8. Embryo in the stage of primitive streak development. Iron haematoxylin
9. Embryo in the stage of neural tube, somites and notochord formation. Iron haematoxylin
10. Embryo in the stage of trunk and amniotic folds development. Iron haematoxylin
11. Umbilical cord. Haematoxylin and eosin
12. Maternal placenta. Haematoxylin and eosin
13. Fetal placenta. Haematoxylin and eosin

List of the electron microphotographs, which are necessary to identify during the control of module 1

- | | |
|---|--|
| 1. Scheme of the molecular structure of the plasmalemma | 11. Cilia (apical surface of the ciliated columnar cells of the nasal cavity mucosa) |
| 2. System of the intercellular junctions | 12. Flagellum (tail of the spermatozoon) |
| 3. Rough endoplasmic reticulum | 13. Inclusions of glycogen in hepatocytes (liver) |
| 4. Smooth endoplasmic reticulum | 14. Inclusions of lipid in cytoplasm of hepatocytes |
| 5. Golgi complex | 15. Fragment of the nucleus |
| 6. Mitochondrion | 16. Structure of the nucleolus |
| 7. Lysosomes | 17. Spermatozoon |
| 8. Peroxisomes | 18. Oocyte (fragment of the ovary follicle) |
| 9. Ribosomes | |
| 10. Cell center – centrosome | |

GENERAL HISTOLOGY

CONTENT MODULE 2

PRACTICAL CLASS № 10



THEME: The study of tissues. Epithelial tissues: covering and glandular epithelia

Specimen №1. Simple squamous epithelium (mesothelium of the peritoneum) Stained with: silver impregnation 1.Nucleus; 2.Cytoplasm; 3.Cell's boundaries	Specimen №2. Simple columnar epithelium (renal tubules) Stained with: haematoxylin and eosin 1.Basement membrane; 2.Epithelial cells: a)nucleus; b)cytoplasm; 3.Lumen of the tubule	Diagram №1. Simple columnar pseudostratified ciliated epithelium (trachea) 1.Basement membrane; 2.Ciliated cells; 3.Goblet cells: a)nucleus; b)secretory granules; 4.Basal (stem) cells; 5.Cell nuclei
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PRACTICAL CLASS № 11



THEME: Blood: erythrocytes, thrombocytes

Specimen №1. Human blood smear
Giemsa stain

1.Erythrocytes; 2.Neutrophils: a)juvenile neutrophil; b)neutrophil with band-shaped nucleus; c)neutrophil with segmented nucleus;
3.Eosinophil; 4.Basophil; 5.Lymphocyte; 6.Monocyte; 7.Thrombocytes

Specimen №2. Frog blood smear
Stained with: haematoxylin and eosin

1.Erythrocytes: a)nucleus; 2.Neutrophils; 3.Eosinophil; 4.Basophil;
5.Lymphocyte; 6.Monocyte; 7.Thrombocytes

PRACTICAL CLASS № 12



THEME: Blood: leukocytes. Lymph

<i>Electron microphotography №1.</i> Neutrophils 1.Lobe of the nucleus; 2.Primary granules (lysosomes); 3.Secondary granules (specific granules); 4.Microvilli	<i>Electron microphotography №2.</i> Eosinophil 1.Lobe of the nucleus; 2.Primary granules (lysosomes); 3.Secondary granules (specific granules)	<i>Electron microphotography №3.</i> Basophil 1.Lobe of the nucleus; 2.Primary granules (lysosomes);); 3.Secondary granules (specific granules)
<i>Electron microphotography №4.</i> Monocyte 1.Horseshoe-shaped nucleus; 2.Lysosomes; 3.Plasmalemma; 4.Microvilli	<i>Electron microphotography №5.</i> Small light lymphocyte 1.Nucleus; 2.Cytoplasm 3.Microvilli; 4.Invaginations of the nuclear envelope	<i>Electron microphotography №6.</i> Small dark lymphocyte 1.Nucleus; 2.Cytoplasm

Leukocyte formula

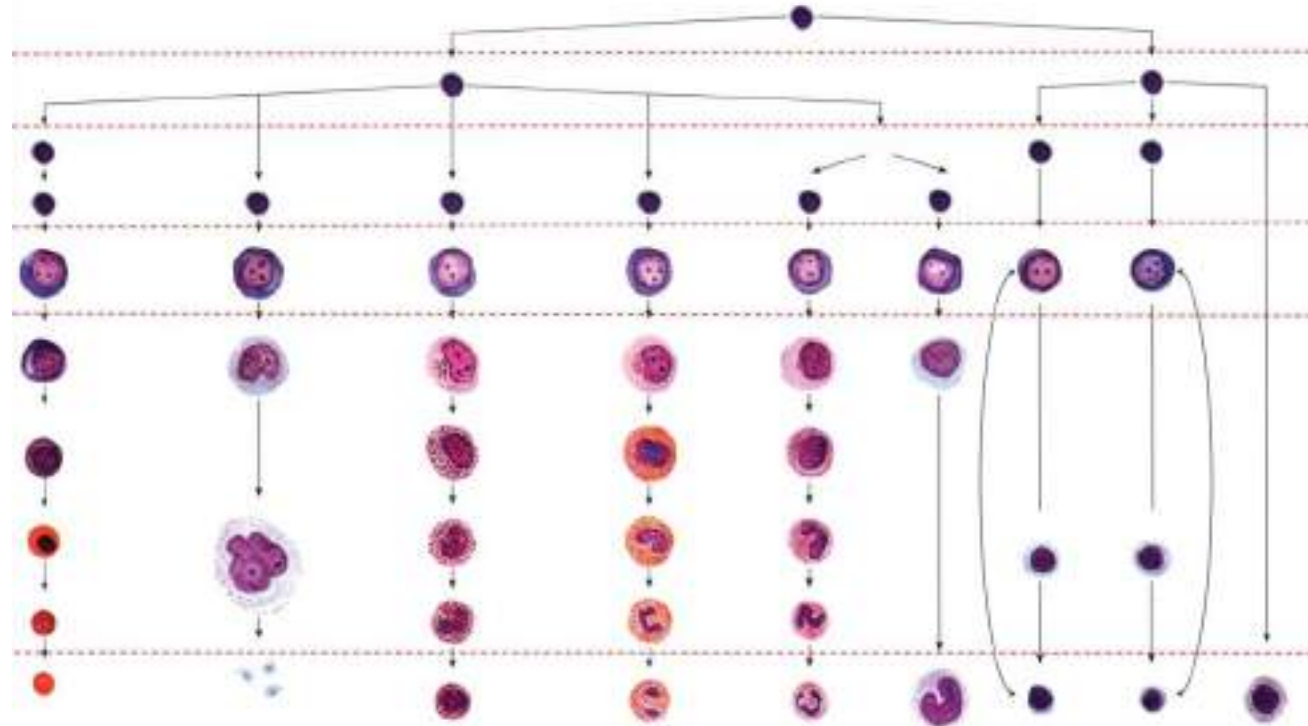
GRANULOCYTES %					AGRANULOCYTES %	
Basophils	Eosinophils	Neutrophils			Lymphocytes	Monocytes
		juvenile	with band-shaped nucleus	with segmented nucleus		

PRACTICAL CLASS № 13



THEME: Embryonic and postembryonic haemopoiesis

Diagram №1. Haemopoiesis



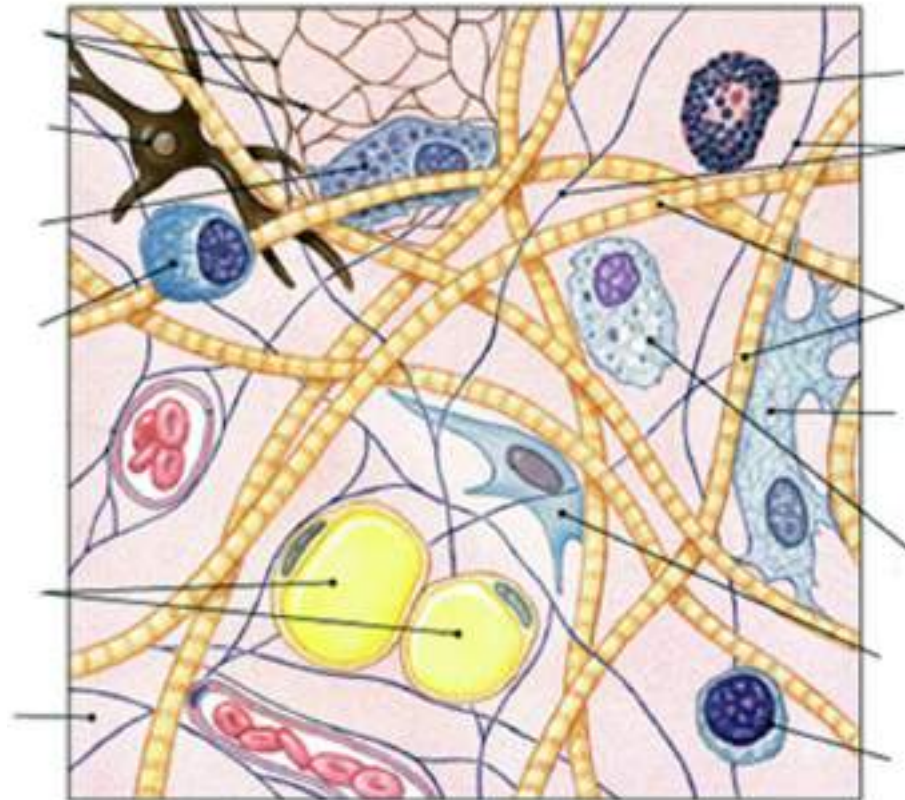
Stages of the blood cell development: I - PPSC – totipotent stem cell; II - MPmc – multipotential myeloid cell; MPlc – multipotential lymphoid cell; III - ECFC – erythrocyte-colony-forming cell; MCFC – monocyte-colony-forming cell; LCFC – lymphocyte-colony-forming cell; MegCFC – megakaryocyte-colony-forming cell; GCFC – granulocyte-colony-forming cell; ECFC – eosinophil-colony-forming cell; BCFC – basophil-colony-forming cell; IV – blasts; V – maturing cells; VI – mature blood cells: E – Erythrocyte; P – Platelets; M – Monocyte; N – Neutrophilic granulocyte; Eos – Eosinophilic granulocyte; B – Basophilic granulocyte; B-l and T-l – B and T lymphocytes

PRACTICAL CLASS № 14



THEME: Connective tissue. Loose connective tissue

Diagram №1. Structural organization of the loose connective tissue



1.Fibroblast; 2.Macrophage; 3.Plasma cell; 4.Mast cell; 5.Lymphocyte; 6.Pigmented cell (melanocyte); 7.Adipose cell; 8.Intercellular substance: a) collagen fibers; b) elastic fibers; c) reticular fibers

PRACTICAL CLASS № 15



THEME: Dense connective tissue. Connective tissues with special properties

Specimen №1. Dense regular connective tissue
(tendon on the longitudinal section)

Stained with: haematoxylin and eosin

1.Bundle of the collagenous fibers (primary bundle); 2.Bundle of the collagenous fibers (secondary bundle); 3.Fibrocyte nuclei; 4.Connective tissue between bundles; 5.Interfascicular connective tissue; 6.Blood vessels

Specimen №2. White adipose tissue
(peritoneum surface view)

Stained with: sudan III

1.Group of adipocytes; 2.Adipose cell: a)nucleus; b)cytoplasm; c)lipid droplet

Specimen №1. Hyaline cartilage (transverse section of the costal cartilage) Stained with: haematoxylin and eosin	Specimen №2. Elastic cartilage (section of the auricle) Stained with: orcein	Specimen №3. Fibrocartilage (intervertebral disc) Stained with: haematoxylin and eosin
I.Perichondrium: 1.Blood vessels; 2.Chondroblasts; II.Cartilage: 3.Isogenous groups of chondrocytes; 4.Intercellular substance	I.Perichondrium: 1.Blood vessels; 2.Chondroblasts; II.Cartilage: 3.Isogenous groups of chondrocytes; 4.Intercellular substance: a)ground substance; b)elastic fibers	1.Fibrocytes; 2.Chondrocytes; 3.Isogenous groups of chondrocytes; 4.Intercellular substance

1.Fibrocytes; 2.Chondrocytes; 3.Isogenous groups of chondrocytes; 4.Intercellular substance

PRACTICAL CLASS № 17



THEME: Skeletal connective tissues: bone

Specimen №1. Compact bone (transverse section of the tubular bone diaphysis)

Stained with: Shmorl method

I.Periosteum.

II.Bone: 1.Layer of outer circumferential lamellae; 2. Osteonal layer; 3.Osteon: a)Haversian canal; b)osteocytes; c) cells' processes; 4.Interstitial lamellae; 5. Layer of inner circumferential lamellae;

III.Endosteum

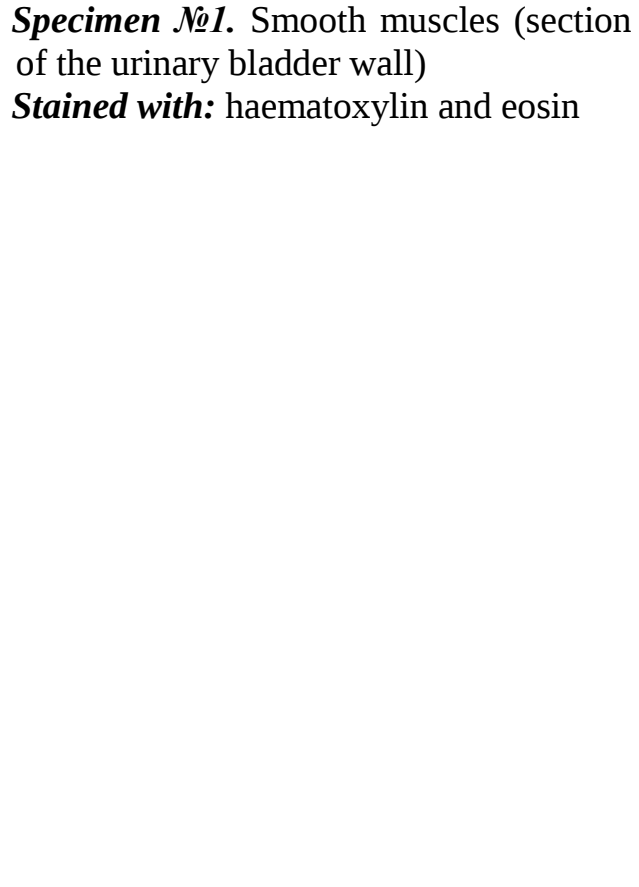
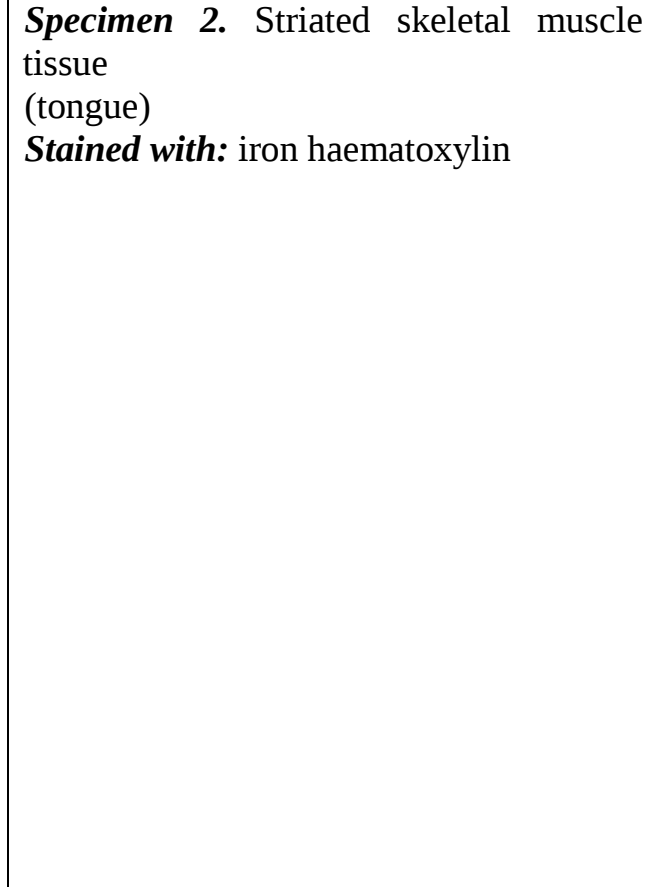
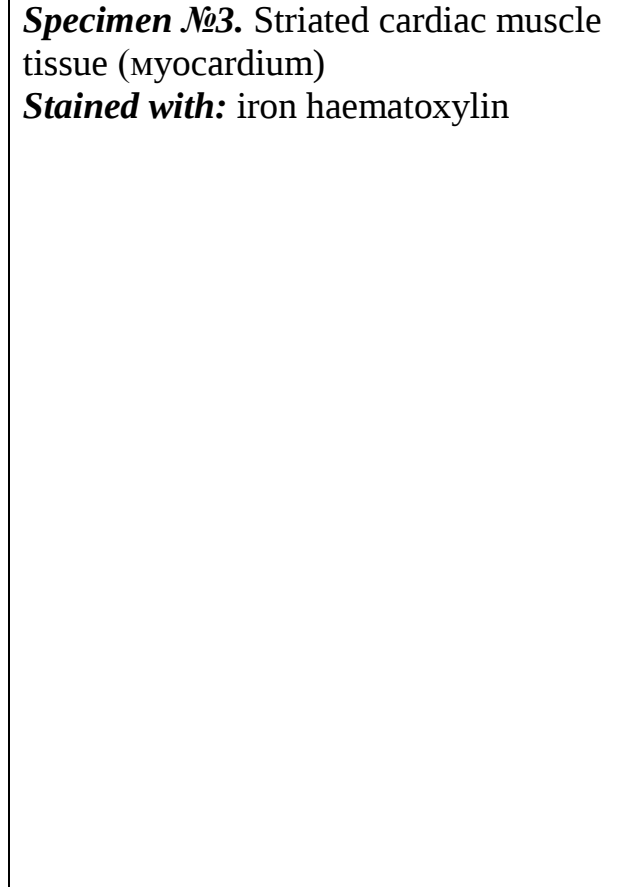
Specimen №2. Endochondral ossification

Stained with: haematoxylin and eosin

I.Epiphysis: 1.Zone of the reserve cartilage;

II. Metaphysial plate: 2.Zone of proliferation; 3.Zone of hypertrophy and calcification; 4.Zone of cartilage degeneration;

III.Diaphysis: 5.Periosteum; 6.Cuff of periosteal bone; 7.Osteogenic tissue

Specimen №1. Smooth muscles (section of the urinary bladder wall) Stained with: haematoxylin and eosin  1.Smooth muscle cell (longitudinal section): a)sarcolemma; b)sarcoplasm; c)nucleus; 2.Smooth muscle cell (transverse section): a)sarcolemma; b)sarcoplasm; c)nucleus;3.Connective tissue	Specimen 2. Striated skeletal muscle tissue (tongue) Stained with: iron haematoxylin  1.Skeletal muscle fiber: a)sarcolemma; b)sarcoplasm; c)nuclei of the muscle fiber; d)cross-striation; e)myofibrils	Specimen №3. Striated cardiac muscle tissue (myocardium) Stained with: iron haematoxylin  1.Cardiac muscle cell: a)nucleus; b)myofibrils; 2.Intercalated discs; 3.Anastomosis between muscle fibers; 4.Loose connective tissue with blood vessels
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PRACTICAL CLASS № 19

THEME: Nervous tissue: neurons, neuroglia, nerve fibers, nerve endings

Specimen №1. Nissl bodies in the multipolar neurons of the spinal cord Stained with: methylene blue 1.Perikaryon; 2.Nissl bodies; 3.Nucleus; 4.Axon; 5.Dendrites	Specimen №2. Myelinated nerve fibers Stained with: osmic acid 1.Axon; 2.Myelin sheath; 3.Neurolemma; 4.Nodes of Ranvier; 5.Incision of the myelin	Specimen №3. Unmyelinated nerve fibers Stained with: haematoxylin and eosin 1.Axon; 2.Neurolemma; 3.Shwann cell nuclei
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PRACTICAL CLASS № 20



THEME: Control of the content module 2

List of the specimens, which are necessary to identify during the control of content module 2

1. Mesothelium of the peritoneum. Silver impregnation
2. Simple cuboidal epithelium of the kidney. Haematoxylin and eosin
3. Simple columnar pseudostratified ciliated epithelium of the trachea. Haematoxylin and eosin
4. Stratified squamous nonkeratinized epithelium of the human cornea. Haematoxylin and eosin
5. Epidermis (fingertip skin). Haematoxylin and eosin
6. Transitional epithelium. Haematoxylin and eosin
7. Blood smear. Giemsa stain
8. Frog's blood smear. Haematoxylin and eosin
9. Dense connective tissue (tendon on the transverse section). Haematoxylin and eosin
10. White adipose tissue. Sudan III
11. Hyaline cartilage. Haematoxylin and eosin
12. Elastic cartilage. Orcein
13. Fibrocartilage. Haematoxylin and eosin
14. Lamellar bone. Shmorl method
15. Intramembranous ossification. Haematoxylin and eosin
16. Endochondral ossification. Haematoxylin and eosin
17. Smooth muscles. Haematoxylin and eosin
18. Skeletal muscles of the tongue. Iron haematoxylin
19. Cardiac muscle tissue (myocardium). Iron haematoxylin
20. Chromophilic substance (Nissl substance). Methylene blue
21. Pseudounipolar neurons of the spinal ganglion. Haematoxylin and eosin
22. Myelinated nerve fibers. Osmic acid
23. Unmyelinated nerve fibers. Haematoxylin and eosin

List of the electron microphotographs, which are necessary to identify during the control of content module 2

1. Simple squamous epithelium (inner epithelium of the cornea)
2. Simple columnar epithelium (epithelium of the mucosa small intestine villi)
3. Pseudostratified columnar epithelium (epithelium of the trachea mucosa)
4. Erythrocytes – discocytes
5. Erythrocytes – echinocytes
6. Thrombocytes
7. Megakaryocyte
8. Granular leukocyte. Neutrophil (with segmented nucleus)
9. Granular leukocyte. Eosinophil
10. Granular leukocyte. Basophil
11. Lymphocyte (small light)
12. Lymphocyte (small dark)
13. Lymphocyte (medium)
14. Plasma cell
15. Monocyte
16. Loose connective tissue
17. Macrophage – histiocyte
18. Plasma cell in the loose connective tissue
19. Isogenous group of chondrocytes (hyaline cartilage)
20. Osteocyte
21. Smooth muscle cell (muscularis externa of the small intestine)
22. Striated skeletal muscle fiber
23. Fragment of cardiac muscle cell sarcoplasm
24. Neuron (cerebral cortex)
25. Oligodendrocyte (spinal ganglion)
26. Ependymal cells (wall of the cerebrospinal canal)
27. Non-myelinated nerve fiber
28. Myelinated nerve fiber
29. Synapse

PRACTICAL CLASS № 21-22



THEME: Final control test of the module I (practical skills)

List of the specimens, which are necessary to identify during the control of module I

1. Golgi complex in the neurons of the spinal cord. Osmic impregnation
2. Neurofibrills in the cytoplasm of nervous cell. Silver impregnation
3. Inclusions of glycogen in hepatocytes. PAS – reaction
4. Lipid inclusions. Sudan black, safranin
5. Mitosis of the plant cell. Iron haematoxylin
6. Oocyte. Haematoxylin and eosin
7. Spermatozoa of guinea pig. Nigrozin and eosin
8. Embryo in the stage of primitive streak development. Iron haematoxylin
9. Embryo in the stage of neural tube, somites and notochord formation. Iron haematoxylin
10. Embryo in the stage of trunk and amniotic folds development. Iron haematoxylin
11. Umbilical cord. Haematoxylin and eosin
12. Maternal placenta. Haematoxylin and eosin
13. Fetal placenta. Haematoxylin and eosin
14. Mesothelium of the peritoneum. Silver impregnation
15. Simple cuboidal epithelium of the kidney. Haematoxylin and eosin
16. Simple columnar pseudostratified ciliated epithelium of the trachea. Haematoxylin and eosin
17. Stratified squamous nonkeratinized epithelium of the human cornea. Haematoxylin and eosin
18. Epidermis (fingertip skin). Haematoxylin and eosin
19. Transitional epithelium. Haematoxylin and eosin
20. Blood smear. Giemsa stain
21. Frog's blood smear. Haematoxylin and eosin
22. Dense connective tissue (tendon on the transverse section). Haematoxylin and eosin
23. White adipose tissue. Sudan III, haematoxylin
24. Hyaline cartilage. Haematoxylin and eosin
25. Elastic cartilage. Orcein
26. Fibrocartilage. Haematoxylin and eosin
27. Lamellar bone. Shmorl method
28. Endochondral ossification. Haematoxylin and eosin
29. Smooth muscles. Haematoxylin and eosin
30. Intramembranous ossification. Haematoxylin and eosin
31. Skeletal muscles of the tongue. Iron haematoxylin
32. Cardiac muscle tissue (myocardium). Iron haematoxylin
33. Chromatophilic substance (Nissl substance). Methylene blue
34. Pseudounipolar neurons of the spinal ganglion. Haematoxylin and eosin
35. Myelinated nerve fibers. Osmic acid
36. Unmyelinated nerve fibers. Haematoxylin and eosin

List of the electron microphotographs, which are necessary to identify during the control of module I

1. Scheme of the molecular structure of the plasmalemma
2. System of the intercellular junctions
3. Rough endoplasmic reticulum
4. Smooth endoplasmic reticulum
5. Golgi complex
6. Mitochondrion
7. Lysosomes
8. Peroxisomes
9. Ribosomes
10. Cell center – centrosome
11. Cilia (apical surface of the ciliated columnar cells of the nasal cavity mucosa)
12. Flagellum (tail of the spermatozoon)
13. Inclusions of glycogen in hepatocytes (liver)
14. Inclusions of lipid in cytoplasm of hepatocytes
15. Fragment of the nucleus
16. Structure of the nucleolus
17. Spermatozoon
18. Oocyte (fragment of the ovary follicle)
19. Simple squamous epithelium (inner epithelium of the cornea)
20. Simple columnar epithelium (epithelium of the mucosa small intestine villi)
21. Pseudostratified columnar epithelium (epithelium of the trachea mucosa)
22. Erythrocytes – discocytes
23. Erythrocytes – echinocytes
24. Thrombocytes
25. Megakaryocyte
26. Granular leukocyte. Neutrophil (with segmented nucleus)
27. Granular leukocyte. Eosinophil
28. Granular leukocyte. Basophil
29. Lymphocyte (small light)
30. Lymphocyte (small dark)
31. Lymphocyte (medium)
32. Plasma cell
33. Monocyte
34. Loose connective tissue
35. Macrophage – histiocyte
36. Plasma cell in the loose connective tissue
37. Isogenous group of chondrocytes (hyaline cartilage)
38. Osteocyte
39. Smooth muscle cell (muscularis externa of the small intestine)
40. Striated skeletal muscle fiber
41. Fragment of cardiac muscle cell sarcoplasm
42. Neuron (cerebral cortex)
43. Oligodendrocyte (spinal ganglion)
44. Ependymal cells (wall of the cerebrospinal canal)
45. Non-myelinated nerve fiber
46. Myelinated nerve fiber
47. Synapse

SPECIAL HISTOLOGY AND EMBRYOLOGY

MODULE II

SPECIAL HISTOLOGY AND EMBRYOLOGY OF THE REGULATORY AND SENSORY SYSTEMS

CONTENT MODULE 3



PRACTICAL CLASS № 23

THEME: Cardiovascular system. Arteries and veins. Microcirculatory bed

<i>Specimen №1.</i> Elastic artery (aorta) <i>Stained with:</i> orcein	<i>Specimen №2.</i> Muscular artery <i>Stained with:</i> haematoxylin and eosin	<i>Specimen №3.</i> Muscular vein <i>Stained with:</i> haematoxylin and eosin
1.Tunica intima: a)layer of endothelial cells; b)subendothelial layer; 2.Tunica media: a)fenestrated elastic membranes; 3.Tunica adventitia: a)vasa vasorum	1.Tunica intima: a)layer of endothelial cells; b)subendothelial layer; c)internal elastic lamina; 2.Tunica media; 3.Tunica adventitia: a)vasa vasorum	1.Tunica intima: a)layer of endothelial cells; b)subendothelial layer; 2.Tunica media; 3.Tunica adventitia: a)vasa vasorum; 4.Valves

Specimen №4. Capillaries, arterioles and venules
Stained with: haematoxylin and eosin

1.Arteriole: a)nuclei of the endothelial cells; b)nuclei of smooth muscle cells; 2.Venule: a)blood cells; 3.Capillary; 4.Adventitial cells

Diagram №1. Types of capillaries

I.Somatic capillary: 1.Endothelial cell; 2.Basement membrane; 3.Pericyte; 4.Adventitial cell

II.Visceral capillary: 1.Endothelial cell: a)fenestrae; 2.Basement membrane; 3.Pericyte; 4.Adventitial cell

III.Sinusoidal capillary: 1.Endothelial cell; 2.Basement membrane; 3.Pores; 4.Pericyte

PRACTICAL CLASS № 24



THEME: Heart

Specimen №1. Heart

Stained with: haematoxylin and eosin

I. Endocardium;

II. Myocardium: 1. Atypical cardiac muscle cells (Purkinje fibers); 2. Cardiac muscle cell: a) nucleus; b) cross-striations; d) intercalated disc; 3. Anastomosis between muscle fibers; 4. Connective tissue with blood vessels;

III. Epicardium

PRACTICAL CLASS № 25



THEME: Lymphatic system. Bone marrow. Thymus

Specimen №1. Thymus

Stained with: haematoxylin and eosin

I.Connective tissue capsule: 1.Trabeculae; 2. Blood vessels;

II.Lobule of the gland: 2.Cortex (T – zone); 3.Medulla: a)Hassall's corpuscles; b) T-lymphocytes

PRACTICAL CLASS № 26



THEME: Lymph node

Specimen №1. Lymph node

Stained with: haematoxylin and eosin

1.Connective tissue capsule; 2.Trabeculae: a)blood vessels; 3.Cortex: a)lymphatic nodules; 4.Paracortical zone; 5.Medulla: a)cords;
6.Lymph node sinuses: a)subcapsular sinus

PRACTICAL CLASS № 27



THEME: Spleen

Specimen №1. Spleen

Stained with: haematoxylin and eosin

1.Connective tissue capsule; 2.Trabeculae; 3.White pulp: a)central artery; b)periarterial zone; c)germinal center; d)peripheral white pulp; e)marginal zone; 4.Red pulp

PRACTICAL CLASS № 28



THEME: Nervous system. Spinal cord. Spinal ganglion

Specimen №1. Transverse section of the spinal cord

Stained with: silver impregnation

1. Anterior median sulcus; 2. Posterior median septum; 3. Gray matter; 4. White matter; 5. Anterior horns; 6. Posterior horns; 7. Lateral horns; 8. Central canal of the spinal cord; 9. Anterior cord; 10. Posterior cord; 11. Lateral cord; 12. Multipolar neurons

Specimen №2. Spinal ganglion

Stained with: haematoxylin and eosin

1. Capsule of the ganglion; 2. Dorsal root; 3. Ventral root; 4. Pseudounipolar neurons; 5. Satellite cells; 6. Nerve fibers; 7. Nuclei of the fibroblasts

Diagram №2. Simple reflex arch

A – afferent chain:

1.Pseudounipolar neuron of the spinal ganglion:
a)dendrite; b)perikaryon; c)axon

B – efferent chain:

2.Multipolar neuron of the nuclei motorii of the spinal cord gray matter: a)dendrite; b)perikaryon; c)axon
3.Mixed nerve
4.Skin
5.Skeletal muscle

Diagram №3. Compound reflex arch

A – afferent chain:

1.Pseudounipolar neuron of the spinal ganglion: a)dendrite;
b)perikaryon; c)axon

B – intermediate chain:

2.Multipolar interneuron of the spinal cord gray matter:
a)associative neuron; b)commissural neuron;

C – efferent chain:

3.Multipolar neuron of the nuclei motorii of the spinal cord:
a)dendrite; b)perikaryon; c)axon
4. Mixed nerve
5.Skin;
6.Skeletal muscle

PRACTICAL CLASS № 29



THEME: Large hemispheres of the brain

Specimen №1. Cerebral cortex

Stained with: silver impregnation

I.Gray matter: 1.Molecular layer; 2.Outer granular layer; 3.Pyramidal cell layer; 4.Inner granular layer; 5.Layer of the ganglionic cells:

a)Betz's cell; 6.Multiform cell layer;

II.White matter

PRACTICAL CLASS № 30



THEME: Cerebellum

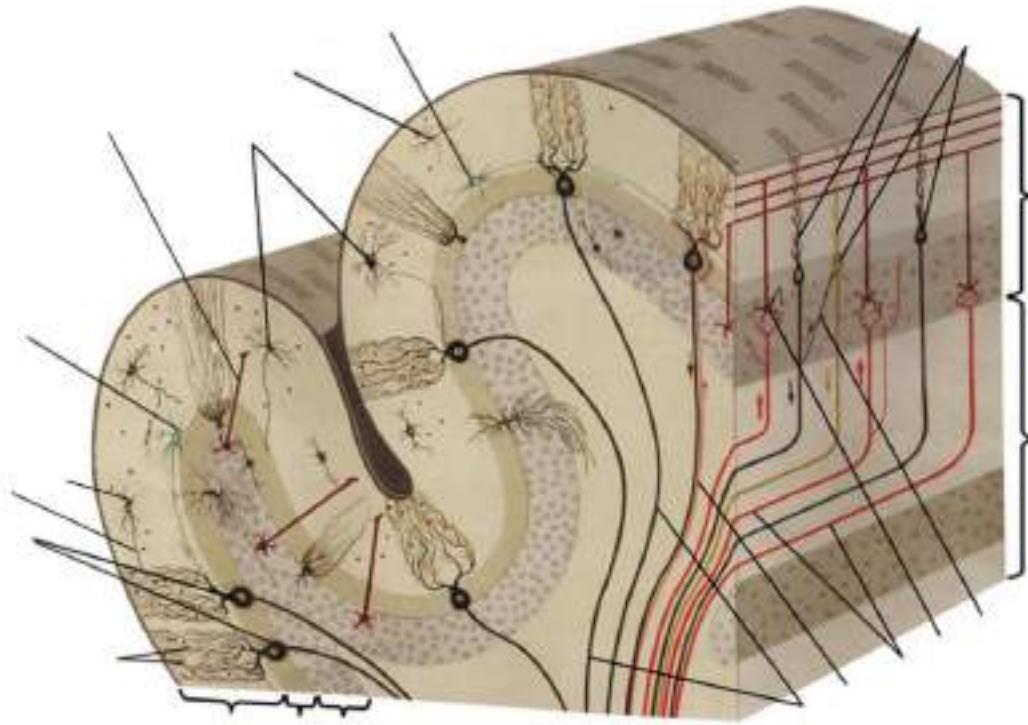
Specimen №1. Cerebellum

Stained with: silver impregnation

I.Gray matter: 1.Molecular layer; 2.Purkinje cell layer: a)Purkinje cells; 3.Granular cell layer;

II.White matter

Diagram №1. Synaptic transmission of the neurons in cerebellum cortex



A. Grey matter: I. Molecular layer; II. Purkinje cell layer; III. Granular cell layer

1. Purkinje cell; 2. Dendrites of Purkinje neuron; 3. Axon of Purkinje neuron; 4. Collaterals of the Purkinje axon; 5. Basket cell; 6. Dendrites of the basket cell; 7. Axon of the basket cell; 8. Stellate cell (with short axon); 9. Stellate cell (with long axon); 10. Dendrites of stellate cell with long axon; 11. Axon of stellate cell with long axon; 12. Dendrites of stellate cell with short axon; 13. Axon of stellate cell with short axon; 14. Granule cell; 15. Axon of the granule cell; 16. Dendrites of the granule cell; 17. Glomerulus of the cerebellum

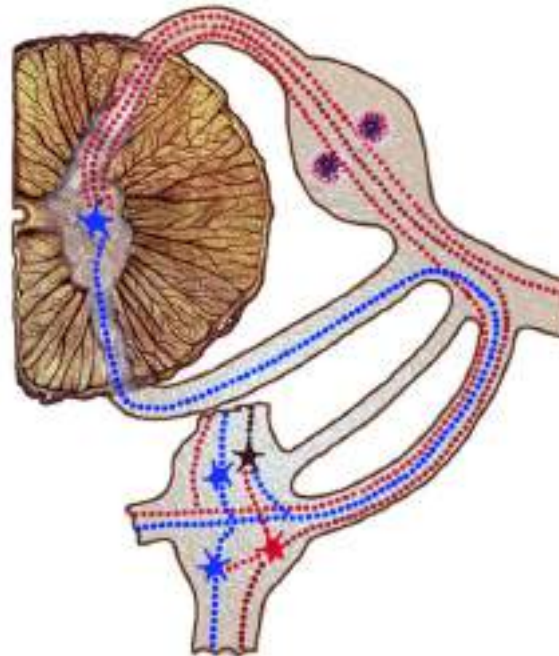
B. White matter: 18. Climbing afferent nerve fiber; 19. Mossy afferent nerve fiber

PRACTICAL CLASS № 31



THEME: Autonomic nervous system

Diagram №1. Autonomic reflex arches



SC – spinal cord; PH – posterior horns; IH – intermediate horns; AH – anterior horns; SG – spinal ganglion: a)PN – pseudounipolar neurons; VG – vegetative ganglion: a)D I – Dogel cell type I (motor); b)D II – Dogel cell type II (sensory); c)DIII – Dogel cell type III (associated); MN – mixed nerve; PreF – preganglionic fiber; PostF –postganglionic fiber

model I:	model II:	model III:
1.Pseudounipolar neuron of the spinal ganglion: a)dendrite; b)perikaryon; c)axon 2.Multipolar neuron of the nucleus lateralis of the spinal cord gray matter: a)dendrite; b)perikaryon; c)axon 3.Multipolar neuron of the autonomic ganglion (Dogel cell type I): a)dendrite; b)perikaryon; c)axon	4.Pseudounipolar neuron of the spinal ganglion: a)dendrite; b)perikaryon; c)axon 5.Multipolar neuron of the nucleus lateralis of the spinal cord gray matter: a)dendrite; b)perikaryon; c)axon 6.Multipolar neuron of the autonomic ganglion (Dogel cell type I): a)dendrite; b)perikaryon; c)axon	7.Multipolar neuron of the autonomic ganglion (Dogel cell type II): a)dendrite; b)perikaryon; c)axon 8.Multipolar neuron of the nucleus lateralis of the spinal cord gray matter: a)dendrite; b)perikaryon; c)axon 9.Multipolar neuron of the autonomic ganglion (Dogel cell type I): a)dendrite; b)perikaryon; c)axon

PRACTICAL CLASS № 32



THEME: Sensory system. Taste organ. Organ of the smell

Diagram №1. Olfactory epithelium

I.Pseudostratified columnar epithelium: 1.Olfactory cells: a)dendrites; б)axon; в)perikaryon; 2. Olfactory bulb; 3.Olfactory cilia; 4.Supporting cells; 5.Basal cells; 6.Basement membrane;
II.Lamina propria of the mucosa: 7.Axons of the olfactory cells; 8.Secretory portions of the Bowman's glands: a)secretory cells; б)myoepithelial cells; 9.Blood vessels

Diagram №2. Taste bud structure

1. Taste bud; 2.Taste pit: a) microvilli; б) adsorbent; c) branches of dendrites; d) nerve ending; 3.Taste pore; 4. Receptor cells; 5.Supporting cells; 6.Basal cells

PRACTICAL CLASS № 33



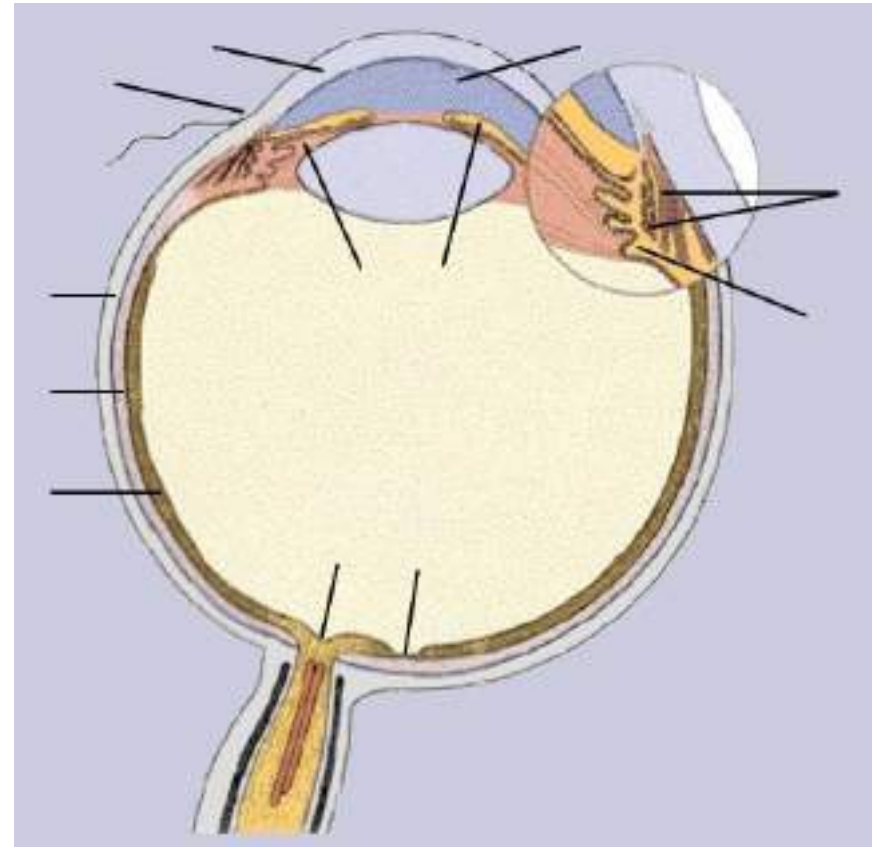
THEME: Eye

Specimen №1. Cornea

Stained with: haematoxylin and eosin

1. Anterior epithelium of the cornea (stratified squamous nonkeratinized epithelium); 2. Bowman's membrane; 3. Stroma of the cornea; 4. Descemet's membrane; 5. Posterior epithelium of the cornea (simple squamous epithelium)

Diagram №1. Structural organization of the human eye



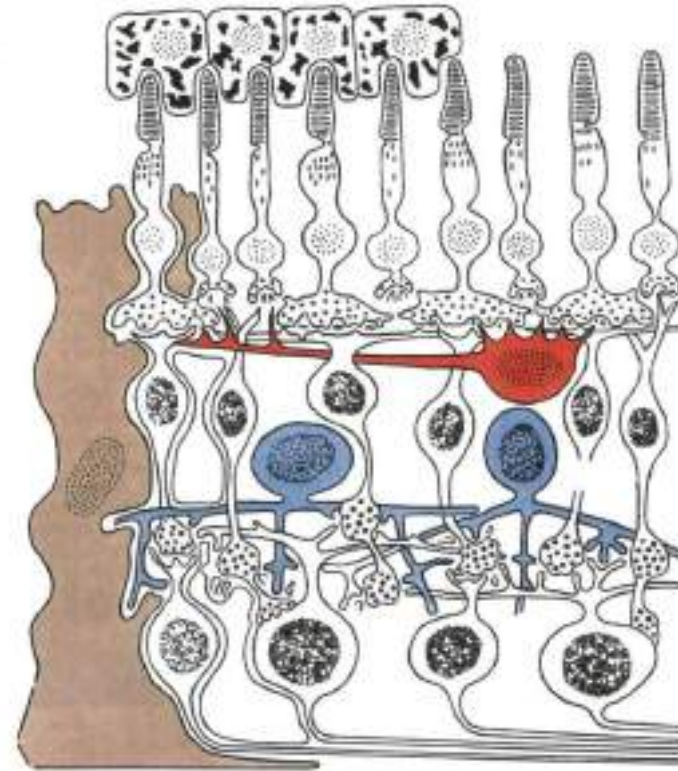
1. Cornea; 2. Sclera; 3. Iris; 4. Choroid; 5. Ciliary body: a) ciliary muscle; b) ciliary processes; 6. Retina; 7. Anterior chamber of the eye; 8. Posterior chamber of the eye; 9. Lens; 10. Vitreous body; 11. Optic nerve papilla; 12. Yellow macula

Specimen №2. Retina

Stained with: haematoxylin and eosin

1. Pigment epithelium; 2. Photosensory layer; 3. External limiting membrane; 4. External nuclear layer; 5. External plexiform layer; 6. Internal nuclear layer; 7. Internal plexiform layer; 8. Ganglion cell layer; 9. Layer of nerve fibers; 10. Internal limiting membrane

Diagram №2. Neurons of the retina



1. Pigment epithelium cells; 2. Photosensory bipolar neuron (rod); 3. Photosensory bipolar neuron (cone); 4. Axons of the photosensory cells; 5. Dendrites of the photosensory cells; 6. Associative bipolar neuron; 7. Horizontal cell; 8. Amacrine cell; 9. Axons of the associative bipolar neurons; 10. Dendrites of the associative bipolar neurons; 11. Ganglion cell; 12. Fibers of the optic nerve; 13. Neuroglia (Muller cell)

PRACTICAL CLASS № 34



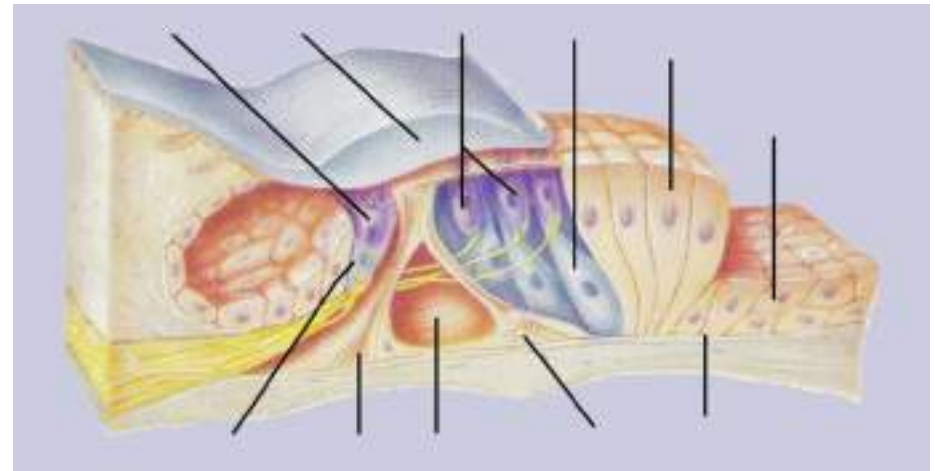
THEME: Audiovestibular organ

Specimen №1. Cochlear axial section

Stained with: haematoxylin and eosin

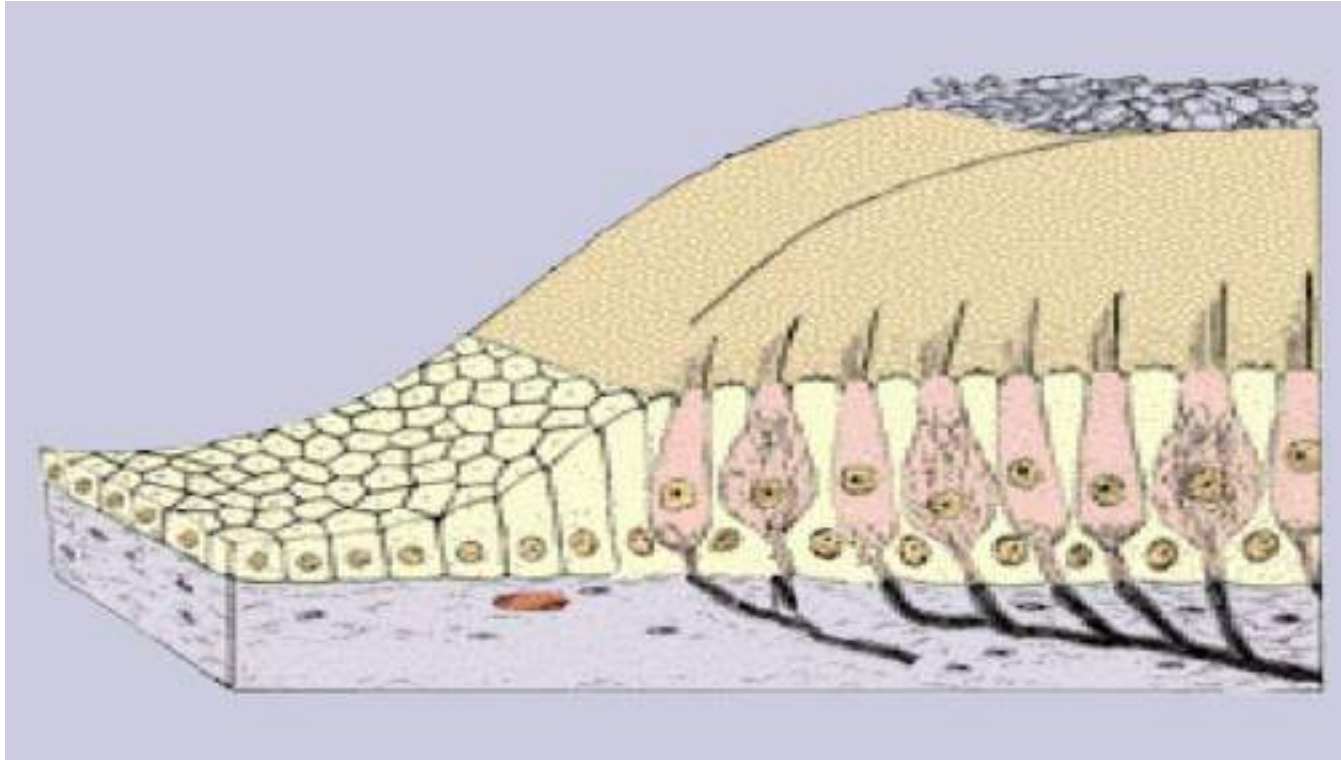
1.Cochlear duct: a)stria vascularis; b)vestibular membrane;
c)basilar membrane; 2.Organ of Corti; 3.Scala tympani; 4.Scala
vestibule; 5.Osseous spiral lamina; 6.Spiral ganglion; 7.Spiral
limbus; 8.Spiral ligament; 9.Tectorial membrane

Diagram №1. Structure of Corti organ



1. Basement membrane basilar membrane; 2.Tunnel; 3.Cells of
Corti organ: a)outer pillar cells; b)inner pillar cells; c)outer
phalangeal cells (Dejters cells); d)inner phalangeal cells; e)outer
hair cells; f)inner hair cells; g)outer bordering cells (Henzen cells);
h)outer supporting cells (Claudius cells); 4.Tectorial membrane

Diagram №2. Maculae structure



1. Supporting cells;
2. Receptor cells (hair cells);
3. Stereocilia;
4. Nerve endings;
5. Myelinated nerve fibers;
6. Otoliths membrane;
7. Otoliths



PRACTICAL CLASS № 35

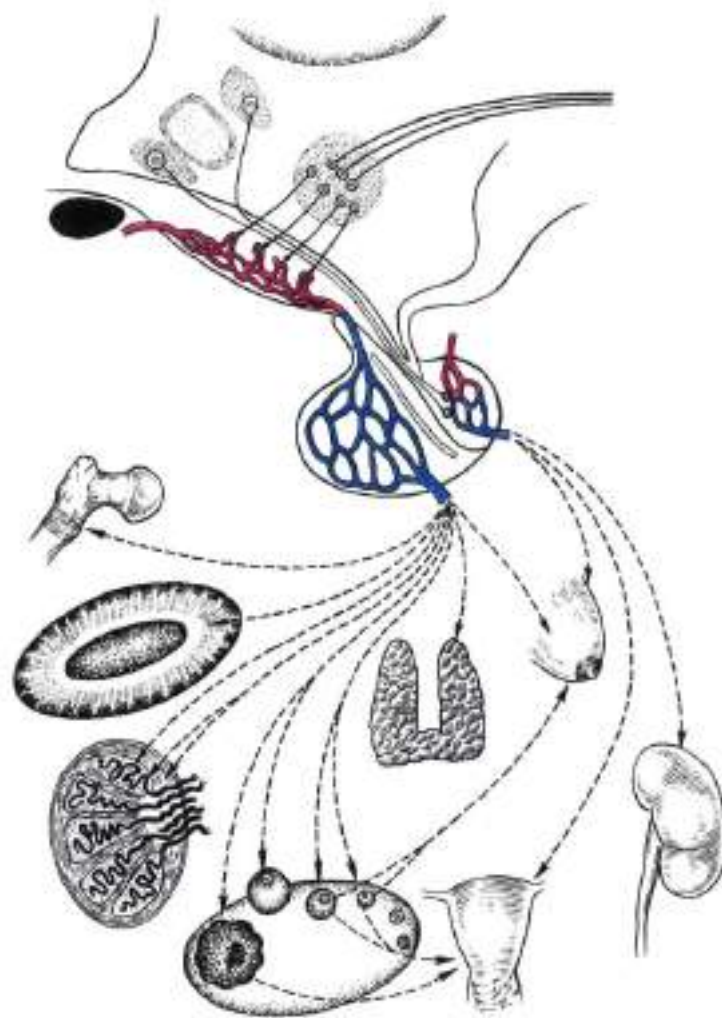
THEME: Endocrine system. Hypothalamus. Pituitary gland. Pineal gland. Dissociative endocrine system

Specimen №1. Pituitary gland

Stained with: haematoxylin and eosin

I. Adenohypophysis: 1. Pars distalis; 2. Pars intermedia; 3. Pars tuberalis; II. Neurohypophysis: 4. Nuclei of the pituicytes; 5. Sinusoidal capillaries

Diagram №2. Hypothalamo-hypophyseal system



1. Median eminence with primary capillary plexus;
2. Nuclei of anterior hypothalamus:
a) supraoptic nucleus; b) paraventricular nucleus;
3. Nuclei of medial hypothalamus;
4. Pituitary stalk;
5. Neurohypophysis;
6. Dilated axon endings (Hering's corpuscles);
7. Hypophyseal cleft;
8. Adenohypophysis with secondary capillary plexus;
9. Venae portae hypophysiales;
10. Pars tuberalis of the adenohypophysis

Adenohypophysial hormones:

GH-growth hormone;
ACTH-adrenocorticotrophic hormone;
LH-luteinizing hormone;
FSH-follicle-stimulating hormone;
TSH-thyrotrophic hormone;
PRL-prolactin;

Hormones that are realized from the neurohypophysis:

ADH-antidiuretic hormone (vasopressin);
Oxytocin

PRACTICAL CLASS № 36



THEME: Thyroid and parathyroid glands

Specimen №1. Thyroid gland

Stained with: haematoxylin and eosin

1.Capsule; 2.Connective tissue; 3.Follicle: a)colloid; b)cuboidal follicle cells; 4.Interfollicular islands; 5.Sinusoidal capillaries

Specimen №2. Parathyroid gland

Stained with: haematoxylin and eosin

1.Cord-like clusters of epithelial cells; 2.Parathyroid cells: a)chief cells; b)oxyphil cells; 3.Sinusoidal capillaries

PRACTICAL CLASS № 37



THEME: Adrenal gland

Specimen №1. Adrenal gland

Stained with: haematoxylin and eosin

1.Capsule; 2.Adrenal cortex: a)zona glomerulosa; b)zona fasciculata; c)zona reticularis; 3.Adrenal medulla; 4.Sinusoidal capillaries

PRACTICAL CLASS № 38



THEME: Control of the content module 3

List of the specimens, which are necessary to identify during the control of content module 3

- | | |
|---|--|
| 1. Muscular artery. Haematoxylin and eosin | 11. Cerebellum. Silver impregnation |
| 2. Elastic artery (aorta). Orsein | 12. Spinal ganglion. Haematoxylin and eosin |
| 3. Muscular vein. Haematoxylin and eosin | 13. Human eye: cornea. Haematoxylin and eosin |
| 4. Arterioles, venules, capillaries. Haematoxylin and eosin | 14. Human eye: retina. Haematoxylin and eosin |
| 5. Heart. Haematoxylin and eosin | 15. Cochlear axial section. Haematoxylin and eosin |
| 6. Thymus. Haematoxylin and eosin | 16. Hypophysis. Haematoxylin and eosin |
| 7. Lymph node. Haematoxylin and eosin | 17. Thyroid gland. Haematoxylin and eosin |
| 8. Spleen. Haematoxylin and eosin | 18. Parathyroid gland. Haematoxylin and eosin |
| 9. Spinal cord. Silver impregnation | 19. Adrenal glands. Haematoxylin and eosin |
| 10. Cerebral cortex. Silver impregnation | |

List of the electron microphotographs, which are necessary to identify during the control of content module 3

- | | |
|---|--|
| 1. Arteriole | 9. Fragment of the adenohypophysis |
| 2. Somatic capillary of the cerebral cortex | 10. Somatotrophic cell. Adenohypophysis |
| 3. Fenestrated capillary. Thyroid gland | 11. Thyrotrophic cell. Adenohypophysis |
| 4. Fragment of the cardiac muscle cell (longitudinal section) | 12. Corticotrophic cell. Adenohypophysis |
| 5. Fragment of the cardiac muscle cell (cross section) | 13. Thyroid gland follicle (normal activity) |
| 6. Junction between cardiac muscle cells | 14. Thyroid gland follicle (hypofunction) |
| 7. Cortex of the thymus | 15. Thyroid gland follicle (hyperfunction) |
| 8. Granular layer of the cerebellar cortex | 16. Adrenal cortex: cell of the zona fasciculata |

SPECIAL HISTOLOGY AND EMBRYOLOGY OF THE INTERNAL ORGANS

CONTENT MODULE 4

PRACTICAL CLASS № 39



THEME: Skin and its derivatives

<i>Specimen №1.</i> Human fingertip skin <i>Stained with:</i> picrofuchsin, resorcin-fuchsin <i>I.Epidermis:</i> 1.Stratum basale; 2.Stratum spinosum; 3.Stratum granulosum; 4.Stratum lucidum; 5.Stratum corneum; <i>II.Dermis:</i> 6.Papillary layer: a)meissner's corpuscle; b) blood vessels; 7.Reticular layer: a) collagen fibers; b)Pacinian corpuscle; <i>III.Hypodermis</i>	<i>Specimen №2.</i> Scalp <i>Stained with:</i> haematoxylin and eosin <i>I.Epidermis;</i> <i>II.Dermis:</i> 1.Papillary layer; 2.Reticular layer; 3.Hair shaft: a) hair bursa; b) external root sheath; c)internal root sheath; b)papillae of hair follicle; 4. Hair shaft: a)cuticle; 6)cortex; 8)medulla; 5.Hair bulb; <i>III.Hypodermis:</i> 6.Arrector pili muscle; 7.Sweat gland: a)secretory portion; b)excretory duct; 8.Sebaceous gland: a)secretory portion; b)excretory duct
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PRACTICAL CLASS № 40

THEME: Organs of the oral cavity. Lips, cheeks, gums, palate, tongue. Structure and development of the tooth

Specimen №1. Filiform and fungiform papillae of the tongue

Stained with: haematoxylin and eosin

Specimen №2. Foliate papillae of the tongue

Stained with: haematoxylin and eosin

1.Filiform papillae: a)stratified squamous keratinized epithelium;
2.Fungiform papillae: a)stratified squamous nonkeratinized epithelium; 3.Lamina propria of the mucosa; 4.Skeletal muscles of the tongue; 5.Taste buds

1.Foliate papillae: a)stratified squamous nonkeratinized epithelium;
2.Lamina propria of the mucosa; 3.Skeletal muscles of the tongue;
4.Taste buds

Specimen №3. Development of the tooth
(the stage of an enamel organ, early stage)
Stained with: haematoxylin and eosin

1.Epithelium of the oral cavity; 2.Enamel organ: a)outer enamel epithelium; b)inner enamel epithelium; c)enamel pulp (stellate reticulum); 3.Neck of the enamel organ; 4.Dental papilla; 5.Dental sac; 6.Bone of dental alveolus; 7.Mesenchyme (connective tissue)

Specimen №4. Development of the tooth
(formation of dentin and enamel, late stage)
Stained with: haematoxylin and eosin

1.Epithelium of the oral cavity; 2.Enameloblasts; 3.Dental pulp; 4.Enamel; 5.Dentin; 6.Predentin; 7.Odontoblasts; 8.Bone of dental alveolus

PRACTICAL CLASS № 41



THEME: Digestive tube. Pharynx, esophagus, stomach

Specimen №1. Cross section of the upper third of the esophagus

Stained with: haematoxylin and eosin

I.Mucosa: 1.Stratified squamous nonkeratinized epithelium; 2.Lamina propria of the mucosa; 3.Lamina muscularis of the mucosa (smooth muscles); 4. Excretory ducts of the esophageal glands;

II.Submucosa: a) secretory portions of the esophageal glands; b) blood vessels;

III.Muscularis externa (skeletal muscle): a)outer longitudinal layer; b)inner circular layer;

IV.Adventitia

Specimen №2. Junction between esophagus and stomach
Stained with: haematoxylin and eosin

ESOPHAGUS

STOMACH

Esophagus:

I.Mucosa:

- 1.Stratified squamous nonkeratinized epithelium
- 2.Lamina propria of the mucosa: a)secretory portions of esophageal cardiac glands
- 3.Lamina muscularis of the mucosa

II.Submucosa

III.Muscularis externa

IV.Serosa

Stomach:

I.Mucosa:

- 1.Simple columnar mucous-secreting epithelium
- 2.Lamina propria of the mucosa
- 3.Lamina muscularis of the mucosa
- 4.Gastric pits

II.Submucosa

III.Muscularis externa

IV.Serosa:

- 5.Loose connective tissue
- 6.Simple squamous epithelium (mesothelium)

Specimen №3. Fundus of the stomach
Stained with: haematoxylin and eosin

I.Mucosa: 1.Gastric pits; 2.Simple columnar mucous-secreting epithelium; 3.Lamina propria of the mucosa: a)fundic glands; 4.Lamina muscularis of the mucosa;
II.Submucosa;
III.Muscularis externa (smooth muscles): a)outer longitudinal layer; b)middle circular layer; c)inner oblique longitudinal layer;
IV.Serosa

Specimen №4. Pyloric region of the stomach
Stained with: haematoxylin and eosin

I.Mucosa: 1.Gastric pits; 2.Simple columnar mucous-secreting epithelium; 3.Lamina propria of the mucosa: a) pyloric glands; 4.Lamina muscularis of the mucosa;
II.Submucosa;
III.Muscularis externa (smooth muscles): a)outer longitudinal layer; b)middle circular layer; c)inner oblique longitudinal layer;
IV.Serosa

PRACTICAL CLASS № 42



THEME: Small intestine

Diagram №1. System „villus – crypt” A.Villus: 1.Absorptive cells; 2.Goblet cells; 3.Enteroendocrine cells B.Crypt: 1.Absorptive cells; 2.Goblet cells; 3.Enteroendocrine cells; 4.Stem cells; 5.Paneth's cells	Specimen №1. Duodenum Stained with: haematoxylin and eosin I.Mucosa: 1.Interstitial villi; 2.Crypts (glands of Lieberkuhn); 3.Simple columnar epithelium with brush border; 4.Lamina propria of the mucosa; 5.Lamina muscularis of the mucosa; II.Submucosa: 6.Secretory portions of duodenal glands; III.Muscularis externa; IV.Serosa	Specimen №2. Jejunum Stained with: haematoxylin and eosin I.Mucosa: 1.Interstitial villi; 2.Crypts (glands of Lieberkuhn); 3.Simple columnar epithelium with brush border; 4.Lamina propria of the mucosa; 5.Lamina muscularis of the mucosa; II.Submucosa: 6.Loose connective tissue; 7.Blood vessels; III.Muscularis externa; IV.Serosa
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PRACTICAL CLASS № 43



THEME: Large intestine

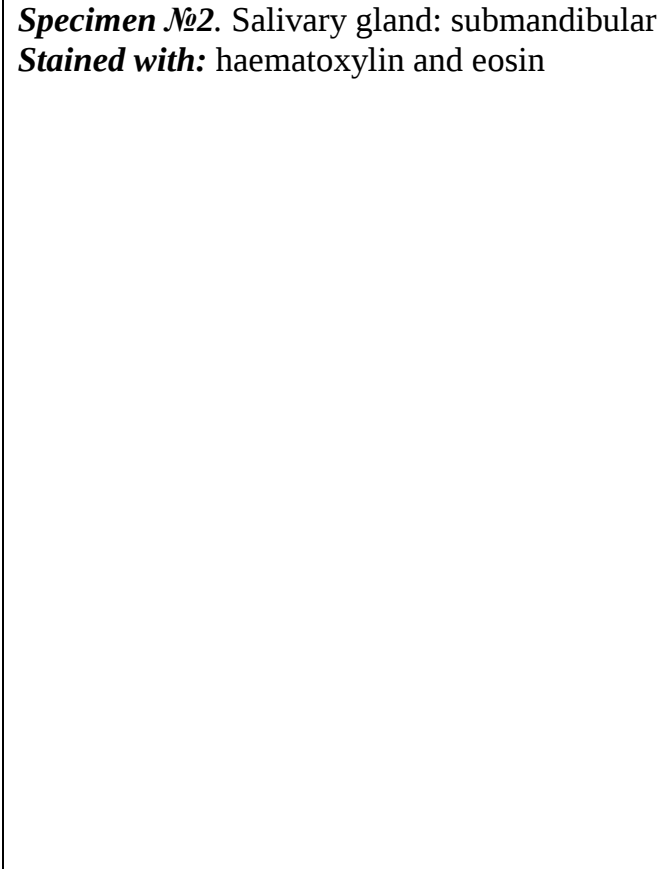
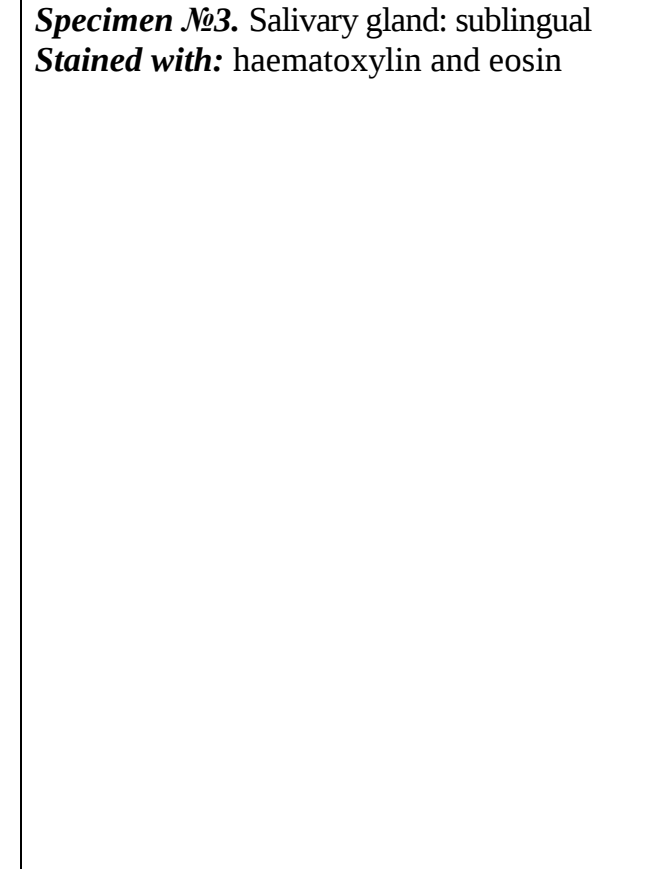
Specimen №1. Large intestine: colon

Stained with: haematoxylin and eosin

I.Mucosa: 1.Crypts; 2.Simple columnar epithelium: a)goblet cells; 3.Lamina propria of the mucosa: a)lymphatic nodules; 4.Lamina muscularis of the mucosa;

II.Submucosa; III.Muscularis externa; IV.Serosa

THEME: Digestive glands. Salivary glands. Pancreas

Specimen №1. Salivary gland: parotid Stained with: haematoxylin and eosin  1.Lobule; 2.Connective tissue interlobular septa; 3.Blood vessels; 4.Serous acinus: a)serous cells; b)myoepithelial cells; c)basement membrane; 5.Excretory ducts: a)interlobular excretory ducts; b)intercalated ducts; c)striated ducts; 6.Excretory ducts	Specimen №2. Salivary gland: submandibular Stained with: haematoxylin and eosin  1.Lobule; 2.Connective tissue interlobular septa; 3.Blood vessels; 4.Serous acinus: a)serous cells; b)myoepithelial cells; c)basement membrane; 5.Mixed acinus: a)mucous cells; b)serous cells (serous demilunes); c)myoepithelial cells; d)basement membrane; 6.Excretory ducts	Specimen №3. Salivary gland: sublingual Stained with: haematoxylin and eosin  1.Lobule; 2.Connective tissue interlobular septa; 3.Blood vessels; 4.Mucous acinus: a)mucous cells; b)myoepithelial cells; c)basement membrane; 5.Serous acinus; 6.Mixed acinus; 7.Excretory ducts
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Specimen №4. Pancreas

Stained with: haematoxylin and eosin

I.Pancreatic acinus: 1.Pancreatic exocrine cells: a)zymogenic zone; b)homogenous zone; c)nucleus;

II.Islet of Langerhans;

III.Interlobular connective tissue: 2.Excretory ducts; 3.Blood vessels

PRACTICAL CLASS № 45



THEME: Liver and biliary tract

Specimen №1. Human liver

Stained with: haematoxylin and eosin

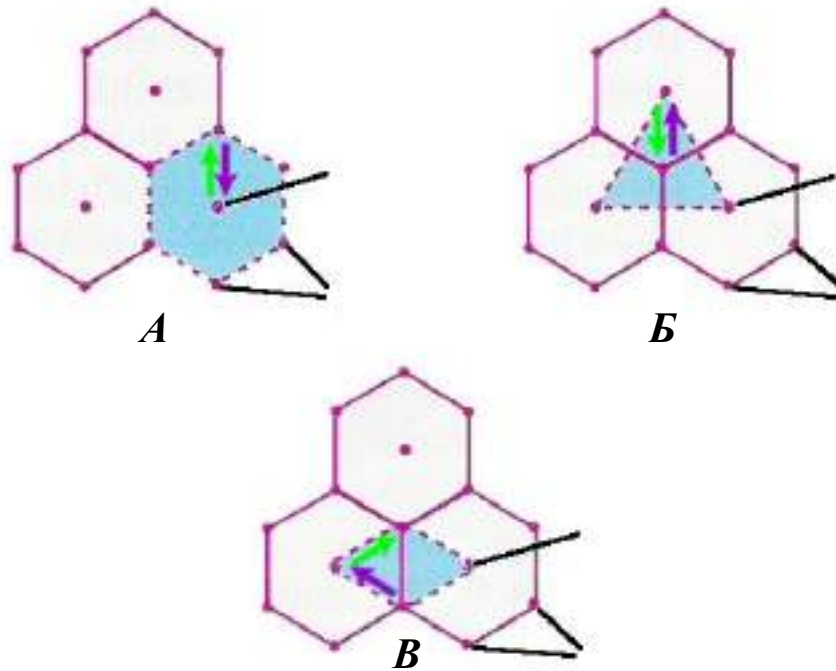
I.Liver lobule: 1.Central vein; 2.Liver plates: a)hepatocytes; b)bile canaliculi; 3.Sinusoidal capillaries; 4.Portal triad: a)interlobular artery; b)interlobular vein; c)interlobular bile duct; II.Interlobular connective tissue

Specimen №2. Pig's liver

Stained with: Van Gieson

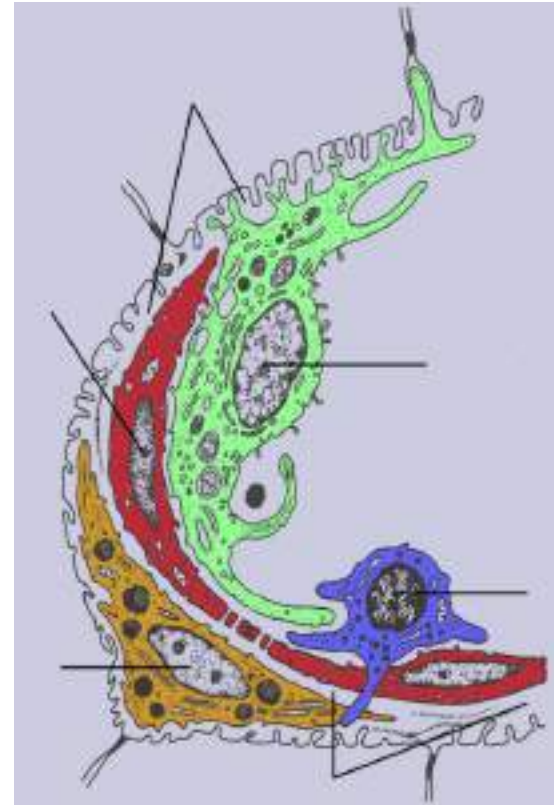
I.Liver lobule: 1.Central vein; 2.Liver plates: a)hepatocytes; b)bile canaliculi; 3.Sinusoidal capillaries; 4.Portal triad: a)interlobular artery; b)interlobular vein; c)interlobular bile duct; II.Interlobular connective tissue

Diagram №1. Structural and functional units of the liver



A. Classic liver lobule; B. Portal liver lobule; B. Liver acinus
 1. Central vein; 2. Portal triad;
Blood flow (red colour); bile flow (green colour)

Diagram №2. Structure of the hepatic sinusoid



1. Endothelial cell: a) fenestrae; 2. Stellate macrophage (Kupffer cell); 3. Fat-storing cell (Ito cell); 4. Lymphocyte with granules (Pit-cell); 5. Space of Disse; 6. Hepatocyte; 7. Lumen of sinusoidal capillary

PRACTICAL CLASS № 46



THEME: Control of the content module 4

List of the specimens, which are necessary to identify during the control of content module 4

1. Human fingertip skin. Picrofuchsin, resorcin-fuchsin
2. Scalp. Haematoxylin and eosin
3. Tongue: filiform and fungiform papillae. Haematoxylin and eosin
4. Tongue: foliate papillae. Haematoxylin and eosin
5. Tooth development (early stage). Haematoxylin and eosin
6. Tooth development (late stage). Haematoxylin and eosin
7. Cross section of the upper third of esophagus. Haematoxylin and eosin
8. Oesophageogastric junction. Haematoxylin and eosin
9. Fundus of the stomach. Haematoxylin and eosin
10. Stomach: pyloric region. Haematoxylin and eosin
11. Small intestine: duodenum. Haematoxylin and eosin
12. Small intestine: jejunum. Haematoxylin and eosin
13. Large intestine. Haematoxylin and eosin
14. Salivary gland: parotid. Haematoxylin and eosin
15. Mixed salivary gland: submandibular or sublingual. Haematoxylin and eosin
16. Pancreas. Haematoxylin and eosin
17. Human liver. Haematoxylin and eosin
18. Pig's liver. Van Gieson

List of the electron microphotographs, which are necessary to identify during the control of content module 4

1. Cells of the stratum basale and stratum spinosum. Epidermis
2. Chief cell. Fundic gland of the gastric mucosa
3. Parietal cell. Fundic gland of the gastric mucosa
4. Mucous neck cells (undifferentiated). Fundic gland of the gastric mucosa
5. Mucous cell. Fundic gland of the gastric mucosa
6. Epithelium of the small intestine villus
7. Epithelium of the small intestine. Crypt of Lieberkuhn (cross section of the crypt)
8. Paneth cell. Fundus of the small intestine crypt
9. Hepatocytes within the classical lobule
10. Acinar cells of the exocrine pancreas (apical pole)
11. Acinar cells of the exocrine pancreas (basal pole)
12. Insulocytes of the islet of Langerhans

Specimen №1. Trachea Stained with: haematoxylin and eosin I.Mucosa: 1.Simple pseudostratified ciliated columnar epithelium: a)ciliated cells; b)basal cells; c)goblet cells; 2.Lamina propria of the mucosa: a) excretory ducts of mixed (serous and mucous) glands; II.Submucosa: 3.Secretory portions of mixed (serous and mucous) glands; 4. Blood vessels; III.Fibro-cartilaginous layer: 5.Hyaline cartilage; IV.Adventitia	Specimen №2. Lung Stained with: haematoxylin and eosin 1.Middle bronchus: a) mucosa, b) submucosa with submucosal glands and blood vessels, c) islands of the hyaline cartilage, d) adventitia; 2.Small bronchus; 3.Terminal bronchiole; 4.Respiratory bronchiole; 5.Alveolar duct; 6.Alveolar sac; 7.Alveolus; 8.Blood vessels
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PRACTICAL CLASS № 48



THEME: Urinary system. Kidney. Endocrine system of kidney. Urinary tract

Specimen №1. Kidney

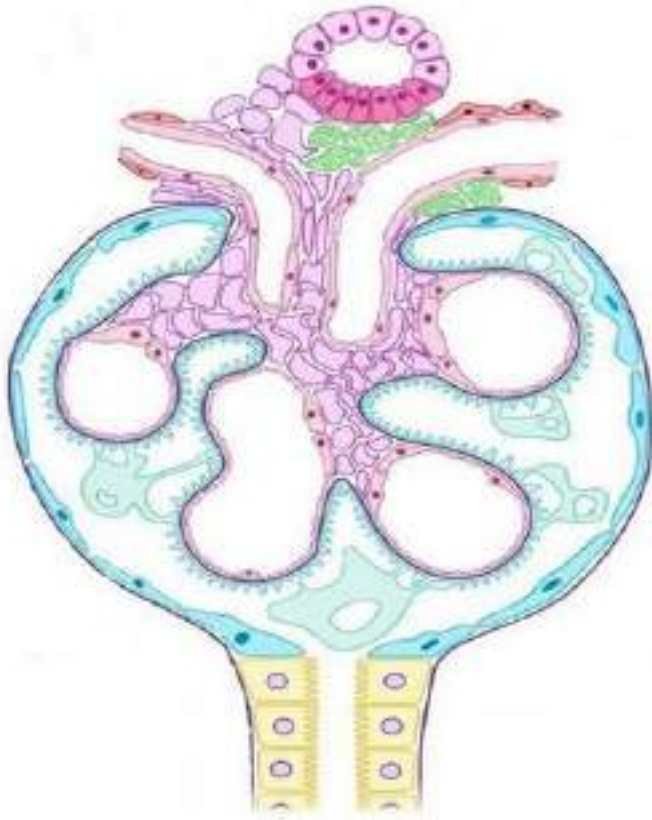
Stained with: haematoxylin and eosin

I.Capsule.

II.Cortex: 1.Renal corpuscle: a)glomerulus; b)parietal layer of Bowman's capsule; c)visceral layer of Bowman's capsule; d)urinary space;
2.Proximal convoluted tubule; 3.Distal convoluted tubule;

III.Medulla: 4.Medullary rays; 5.Renal papilla: a)ascending limbs; b)descending limbs; c) collecting ducts

Diagram №1. Endocrine system of kidney



Afferent arteriole; 2.Efferent arteriole; 3.Distal convoluted tubule;
4.Proximal convoluted tubule; 5.Smooth muscle cells; 6.Macula
densa; 7.Juxtaglomerular cells; 8.Extraglomerular mesangial cells

Specimen №2. Urinary bladder
Stained with: haematoxylin and eosin

I.Mucosa: 1.Transitional epithelium; 2.Lamina propria of the mucosa;
II.Submucosa;
III.Muscularis: a)inner longitudinal layer; b)outer circular layer;
IV.Adventitia

PRACTICAL CLASS № 49



THEME: Male reproductive system

Specimen №1. Testis

Stained with: haematoxylin and eosin

A – testis:

1. Tunica albuginea; 2. Trabeculae; 3. Testicular lobule;
4. Seminiferous tubules

B – transverse section of the seminiferous tubule of testis:

1. Connective tissue tunic; 2. Spermatogenic epithelium: a) Sertoli cells; b) spermatogonia; c) primary and secondary spermatocytes; d) spermatids; e) mature spermatozoa; 3. Interlobular connective tissue: a) Leydig cells (interstitial cells)

Specimen №2. Epididymis

Stained with: haematoxylin and eosin

1. Ductuli efferentes; 2. Ductuli epididymis; 3. Loose connective tissue; 4. Blood vessels

Specimen №3. Prostate gland

Stained with: haematoxylin and eosin

1.Urethra: a)transitional epithelium; 2.Secretory portions of prostatic glands: a)glandular epithelium; b)prostatic juice; 3.Excretory ducts;
4.Smooth muscles

PRACTICAL CLASS № 50



THEME: Female reproductive system. Ovary. Uterine tubes

Specimen №1. Ovary

Stained with: haematoxylin and eosin

I.Germinal epithelium;

II.Tunica albuginea;

III.Cortex: 1.Connective tissue; 2.Follicles in different stages of development: a)primordial follicle; b)primary follicle; c)secondary follicle; d)mature follicle; e)atretic follicle;

IV.Medulla

Specimen №2. Corpus luteum

Stained with: haematoxylin and eosin

1.Connective tissue tunica; 2.Granulosa lutein cells; 3.Blood vessels

PRACTICAL CLASS № 51



THEME: Uterus. Menstrual cycle

Specimen №1. Uterus in the period of rest (11-14 day of the menstrual cycle)

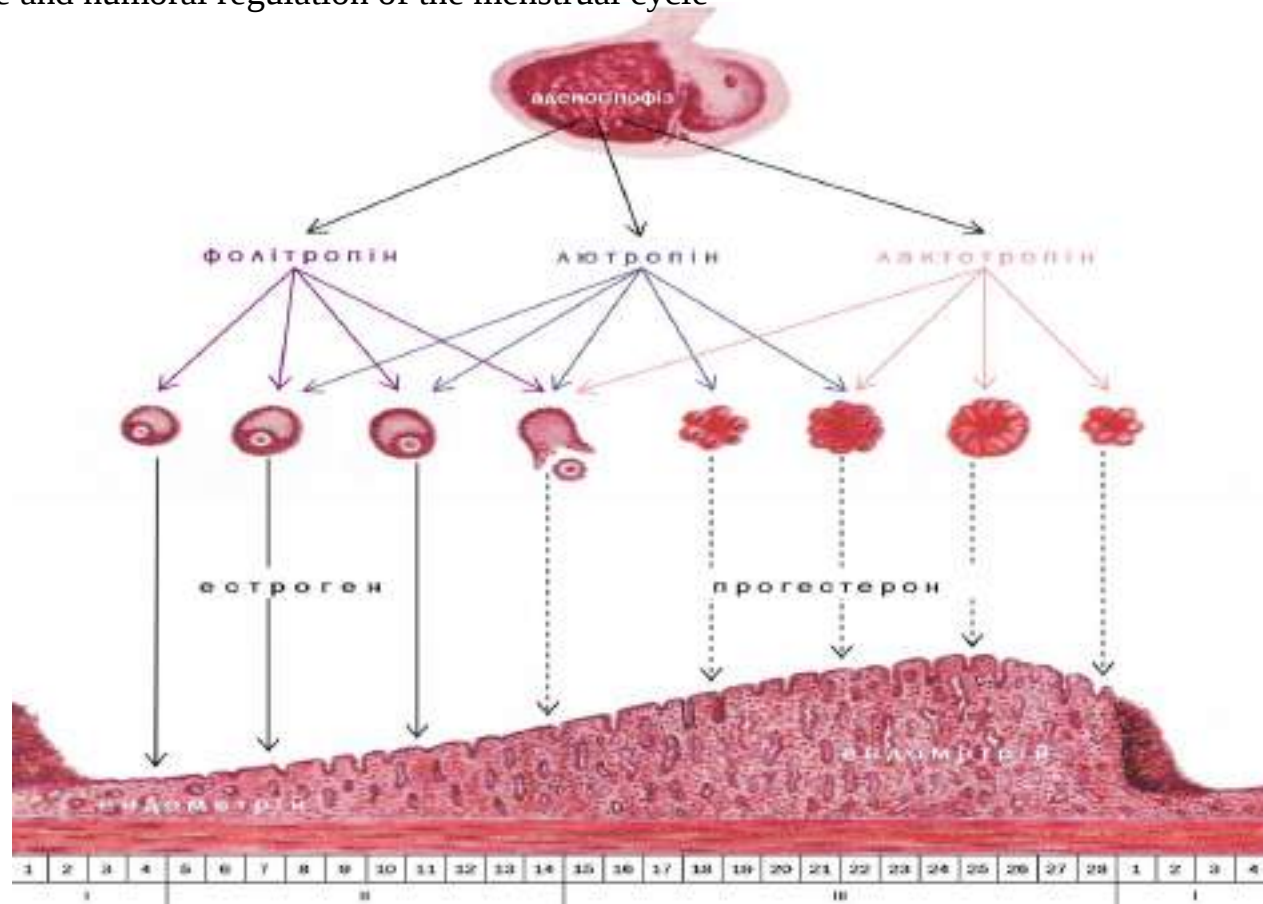
Stained with: haematoxylin and eosin

I.Endometrium: *A-functional layer; B-basal layer*; 1.Simple columnar epithelium; 2.Lamina propria of the mucosa; 3.Uterine glands;

II.Myometrium: 1.Submucosal layer; 2.Vascular layer; 3.Supravascular layer;

III.Perimetrium

Diagram №1. Nerve and humoral regulation of the menstrual cycle



I. Menstrual phase

II. Proliferative phase (follicular phase)

III. Secretory phase (luteal phase)

1. Uterine coiled artery;
2. Uterine straight artery;
3. Spasm of terminal branches of uterine coiled arteries;
4. Endometrial hemorrhage;
5. Primordial follicle in the ovary;

6. Ovarian follicles in various stages of development;
7. Mature (Graafian) follicle;
8. Ovulation;
9. Mature corpus luteum;
10. Inverted development of corpus luteum;
11. Adenohypophysis;
12. Funnel of thalamic brain;
13. Neurohypophysis;

PRACTICAL CLASS № 52



THEME: Female reproductive system. Mammary gland. Contraception

Specimen №1. Mammary gland during lactation

Stained with: haematoxylin and eosin

1.Lobule of gland; 2.Interlobular connective tissue; 3.Glandular alveoli: a)alveolar cells; 4. Lactiferous terminal duct; 5.Lactiferous sinuses; 6.Myoepithelial cells

PRACTICAL CLASS № 53



THEME: Control of the content module 5

List of the specimens, which are necessary to identify during the control of content module 5

1. Trachea. Haematoxylin and eosin
2. Lungs. Haematoxylin and eosin
3. Kidney. Haematoxylin and eosin
4. Urinary bladder. Haematoxylin and eosin
5. Testis. Haematoxylin and eosin
6. Epididymis. Haematoxylin and eosin
7. Prostate gland. Haematoxylin and eosin
8. Ovary. Haematoxylin and eosin
9. Corpus luteum. Haematoxylin and eosin
10. Uterus of the cat in the period of rest. Haematoxylin and eosin
11. Mammary gland during lactation. Haematoxylin and eosin

List of the electron microphotographs, which are necessary to identify during the control of content module 5

1. Respiratory cell of the alveolar epithelium – type I alveolar cell
2. Secretory cell – type II alveolar cell
3. Air-blood barrier – alveolar wall
4. Fragment of the renal corpuscle. Kidney cortex
5. Filtrative barrier in part of the renal corpuscle
6. Epithelial cell of the proximal part of the nephron. Cortex of the kidney
7. Fragment of the basal pole of the epithelial cell in distal part of the nephron
8. Fragment of the seminiferous tubule wall

PRACTICAL CLASS № 54-55



THEME: Final control test of the module II

List of the specimens, which are necessary to identify during the control of module II

1. Muscular artery. Haematoxylin and eosin
2. Elastic artery (aorta). Orsein
3. Muscular vein. Haematoxylin and eosin
4. Arterioles, venules, capillaries. Haematoxylin and eosin
5. Heart. Haematoxylin and eosin
6. Thymus. Haematoxylin and eosin
7. Lymph node. Haematoxylin and eosin
8. Spleen. Haematoxylin and eosin
9. Spinal cord. Silver impregnation
10. Cerebral cortex. Silver impregnation
11. Cerebellum. Silver impregnation
12. Spinal ganglion. Haematoxylin and eosin
13. Human eye: cornea. Haematoxylin and eosin
14. Human eye: retina. Haematoxylin and eosin
15. Cochlear axial section. Haematoxylin and eosin
16. Hypophysis. Haematoxylin and eosin
17. Thyroid gland. Haematoxylin and eosin
18. Parathyroid gland. Haematoxylin and eosin
19. Adrenal glands. Haematoxylin and eosin
20. Human fingertip skin. Picrofuchsin, resorcin-fuchsin
21. Scalp. Haematoxylin and eosin
22. Tongue: filiform and fungiform papillae. Haematoxylin and eosin
23. Tongue: foliate papillae. Haematoxylin and eosin
24. Tooth development (early stage). Haematoxylin and eosin
25. Tooth development (late stage). Haematoxylin and eosin
26. Cross section of the upper third of esophagus. Haematoxylin and eosin
27. Oesophageogastric junction. Haematoxylin and eosin
28. Fundus of the stomach. Haematoxylin and eosin
29. Stomach: pyloric region. Haematoxylin and eosin
30. Small intestine: duodenum. Haematoxylin and eosin
31. Small intestine: jejunum. Haematoxylin and eosin
32. Large intestine. Haematoxylin and eosin
33. Salivary gland: parotid. Haematoxylin and eosin
34. Mixed salivary gland: submandibular or sublingual. Haematoxylin and eosin
35. Pancreas. Haematoxylin and eosin
36. Human liver. Haematoxylin and eosin
37. Pig's liver. Van Gieson
38. Trachea. Haematoxylin and eosin
39. Lungs. Haematoxylin and eosin
40. Kidney. Haematoxylin and eosin
41. Urinary bladder. Haematoxylin and eosin
42. Testis. Haematoxylin and eosin
43. Epididymis. Haematoxylin and eosin
44. Prostate gland. Haematoxylin and eosin
45. Ovary. Haematoxylin and eosin
46. Corpus luteum. Haematoxylin and eosin
47. Uterus of the cat in the period of rest. Haematoxylin and eosin
48. Mammary gland during lactation. Haematoxylin and eosin

List of the electron microphotographs, which are necessary to identify during the control of module II

1. Arteriole
2. Somatic capillary of the cerebral cortex
3. Fenestrated capillary. Thyroid gland
4. Fragment of the cardiac muscle cell (longitudinal section)
5. Fragment of the cardiac muscle cell (cross section)
6. Junction between cardiac muscle cells
7. Cortex of the thymus
8. Granular layer of the cerebellar cortex
9. Fragment of the adenohypophysis
10. Somatotrophic cell. Adenohypophysis
11. Thyrotrophic cell. Adenohypophysis
12. Corticotrophic cell. Adenohypophysis
13. Thyroid gland follicle (normal activity)
14. Thyroid gland follicle (hypofunction)
15. Thyroid gland follicle (hyperfunction)
16. Adrenal cortex: cell of the zona fasciculata
17. Cells of the stratum basale and stratum spinosum. Epidermis
18. Chief cell. Fundic gland of the gastric mucosa
19. Parietal cell. Fundic gland of the gastric mucosa
20. Mucous neck cells (undifferentiated). Fundic gland of the gastric mucosa
21. Mucous cell. Fundic gland of the gastric mucosa
22. Epithelium of the small intestine villus
23. Epithelium of the small intestine. Crypt of Lieberkuhn (cross section of the crypt)
24. Paneth cell. Fundus of the small intestine crypt
25. Hepatocytes within the classical lobule
26. Acinar cells of the exocrine pancreas (apical pole)
27. Acinar cells of the exocrine pancreas (basal pole)
28. Insulocytes of the islet of Langerhans
29. Respiratory cell of the alveolar epithelium – type I alveolar cell
30. Secretory cell – type II alveolar cell
31. Air-blood barrier – alveolar wall
32. Fragment of the renal corpuscle. Kidney cortex
33. Filtrative barrier in part of the renal corpuscle
34. Epithelial cell of the proximal part of the nephron. Cortex of the kidney
35. Fragment of the basal pole of the epithelial cell in distal part of the nephron
36. Fragment of the seminiferous tubule wall