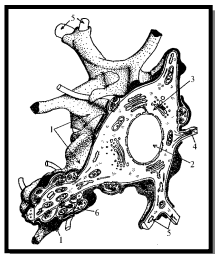


T. M. STUDENIKINA, T. A. VYLEGZHANINA, T. I. OSTROVSKAYA

**HISTOLOGY, CYTOLOGY,
EMBRYOLOGY. PRACTICUM**

Minsk BSMU 2019



МИНИСТЕРСТВО ЗДРАВООХРАНЕНИЯ РЕСПУБЛИКИ БЕЛАРУСЬ
БЕЛОРУССКИЙ ГОСУДАРСТВЕННЫЙ МЕДИЦИНСКИЙ УНИВЕРСИТЕТ
КАФЕДРА ГИСТОЛОГИИ, ЦИТОЛОГИИ И ЭМБРИОЛОГИИ

Т. М. Студеникина, Т. А. Вылегжанина, Т. И. Островская

ГИСТОЛОГИЯ, ЦИТОЛОГИЯ, ЭМБРИОЛОГИЯ. ПРАКТИКУМ

HISTOLOGY, CYTOLOGY, EMBRYOLOGY. PRACTICUM

Допущено Министерством образования Республики Беларусь в качестве учебного пособия
для иностранных студентов учреждений высшего образования по специальности «Лечебное дело»

2-е издание



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The Instructions of the Histology, Cytology and Embryology Department for the students to follow

1. Students have to handle the department property, microscopes and other equipment with care and caution.
2. Students have to follow a dress-code: all coats should be left in the wardrobe and students wear medical gowns.
3. Students are to come to the lectures and the practical classes on time.
4. Students are to have practicum and colored pencils for drawing slides at every practical class.
5. To get the permission for intermediate control, a credit or an exam students are to attend all lectures and practical classes and perform correctly all tasks in the workbook.
6. If students are missing at practical classes, they will have to take a permission and work off a missed class within two weeks. To work off, students should come to the Department according to the schedule with the permission, a workbook and colored pencils and work with the lecturer on duty.
7. If students are missing at lectures, they have to give the lecturer the permission and the notes for the lecture.
8. If students have good marks (4 and higher) as a result of the intermediated control (including the practical skill) the credit will be given at the final practical class.
9. If students have bad results for the intermediated control they will take a credit test (free) at the final practical class.
10. In case of the credit's failure, another attempt (paid) will be set by the lecturer on the basis of the agreement between the student and the lecturer. The student is to obtain permission for the credit and the payment **in advance**.
11. The date of the last attempt to pass a credit (paid) will be set by the Head of the Department for all students. The board of lecturers will supervise the credit. The student is to obtain permission for the credit and the payment **in advance**.
12. The schedule of the exams is set by the Dean and should be **strictly fulfilled**.

I've read the Instruction of the Department: _____ 20____ (signature)

Histology, Cytology, Embryology. Practicum

Student _____ group _____

The results of intermediate control

| Spring term 1st course | Colloquium 1st | | Colloquium 2nd | | Permission to the credit | | |
|-----------------------------------|----------------|--------|----------------|--------|--------------------------|---------|-----------|
| | test | | test | slides | Lectures | Classes | Practicum |
| Mark | | | | | | | |
| Lecturer's signature | | | | | | | |
| Autumn term 2nd course | Colloquium 3rd | | Colloquium 4th | | Permission to the exam | | |
| | test | slides | test | slides | Lectures | Classes | Practicum |
| Mark | | | | | | | |
| Lecturer's signature | | | | | | | |

**Topic 1. MICROSCOPIC AND HISTOLOGICAL TECHNIQUE.
CELL MORPHOLOGY: INTRACELLULAR STRUCTURES**

Tasks, objects and methods of modern histology.
Methods of histological investigations.
Techniques of the histological preparation making.
The principles and methods of staining histological preparations.
 Basophilic and oxyphiliac (acidophylic).
The definition of a “cell”. Cell derivatives. Cellular theory.
Structural organization of cellular synthetic apparatus: ribosomes,
 polyribosomes, endoplasmic reticulum, Golgi complex.
Structural organization of cellular digestion apparatus: endo-
 somes, lysosomes, peroxysomes.
Structural elements of cellular energy apparatus: mitochondria.
Cellular inclusions: classifications, structure and functions.
Nucleus and its components.
Cell cycle.

Definition: **Histology** is

Definition of a “CELL”

Task 1. BIOLOGICAL MICROSCOPE

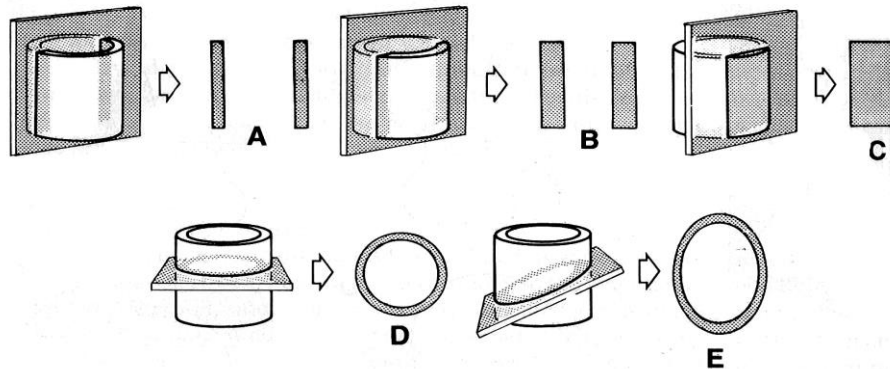
Designate
in the picture:

- 1 — stand;
- 2 — on/off switch
- 3 — illumination intensity control;
- 4 — macrometer focusing knob;
- 5 — micrometer focusing knob;
- 6 — objective revolver;
- 7 — object stage;
- 8 — x-y translation mechanism;
- 9 — specimen holder;
- 10 — ocular;
- 11 — objectives



Instruction for working with a microscope

1. Put a plug in a socket.
2. Turn on (switch on) the microscopes.
3. Turn slightly the regulator of illumination intensity and make the light brighter.
4. Put the glass on the stage *with the cover glass upwards*. Turn the handle of the stage control and set the specimen in the middle of the hole.
5. To focus on the slide, turn the *macrometer focusing knob only*. Lower the drawtube very carefully, *so as not to damage the slide*.
6. Turn the revolver at middle or high magnification. If as necessary, turn the illumination intensity regulator and make the light brighter. To focus on the slide, turn the *micrometer focusing knob only so as not to damage the slide*.
7. After completing the work, turn the revolver at low magnification. After this take the glass off the object stage.
8. Turn the regulator of illumination intensity at minimum and **only after this** switch off the microscope.



Task 2. SERIES OF DIAGRAMS ILLUSTRATING THE APPEARANCE OF SECTIONS OF STRAIGHT TUBE CUT IN VARIOUS PLANES

A, B, C — longitudinal sections cut at different levels relative to the center of the lumen.


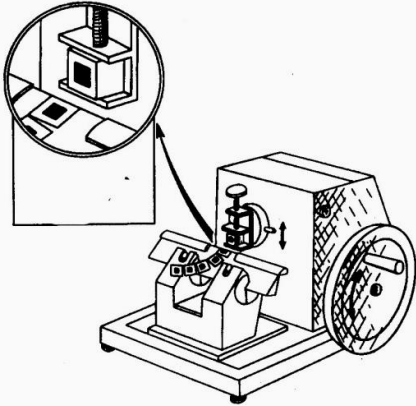
Sections **C** cuts the wall the tube so we can't see the lumen in the section.

D — transverse or cross section.

E — oblique sections.

PATTERN OF BASIC STAGES OF MAKING HISTOLOGICAL PREPARATIONS

To preserve the structural relationship between cells in tissues, it is necessary to cut a very thin slice of the tissue, called the section, that is suitable for the light or the electron microscopy

| Process | Purpose | Process | Purpose |
|--|---|--|--|
| 1. Taking material | For light microscopy take a sample of 1×1×0,5 cm, for electron microscopy — 1×1 mm | 4. Embedding in paraffin A tissue block must be put in suitable medium — paraffin wax or plastic resin  | To obtain thin sections with a microtome, tissues should be infiltrated with embedding substance that impart a rigid consistency to the tissue. |
| 2. Fixation <i>A. Chemical:</i> simple fixators; compound fixators; <i>B. Physical:</i> freezing heating drying microwave treatment | The process of the fixation prevents a tissue from denaturing its proteins, preserves the structure and hardens a soft tissue | 5. Preparation of histological sections with a microtome  | Sections cut for light microscopy should be thin enough to transmit sufficient light, thinner than the diameter of most cells (5–10 μm thin — for transmission light microscopy, 0,05–0,1 μm — for transmission electron microscopy) |
| 3. Dehydration The fixed and rinsed samples are dehydrated in the series of alcohol solutions of ascending concentration (from 70 % to 100 %). The material is kept in each of them from 12 to 24 hours. | The water should be extracted from the samples | 6. Staining, impregnating, contrasting histological preparations 7. Place the section between the cover glass adding a drop of Canadian balsam | The methods are chosen according to the objective of the investigation |

STAINING

Hematoxylin and eosin are the dyes used for histological sections routinely.

Hematoxylin (H) is a basic stain, **eosin (E)** is an acid stain. Substances stained by H are **basophilic**, by E — are **acidophilic (eosinophilic)**.

The results of a staining test:

- **basophilic** cell structures (nucleus, etc.) obtain a **blue** or **violet** color after hematoxylin treatment;
- **acidophilic** structures (cytoplasm, protein granules) obtain a **pink** or **red** color after eosine treatment.

Designate in the scheme:

- 1 — plasma membrane;
- 2 — rough endoplasmic reticulum;
- 3 — ribosomes;
- 4 — Golgi complex;
- 5 — inclusion;

Task 3. CELLULAR STRUCTURE

Staining: Hematoxylin-eosin

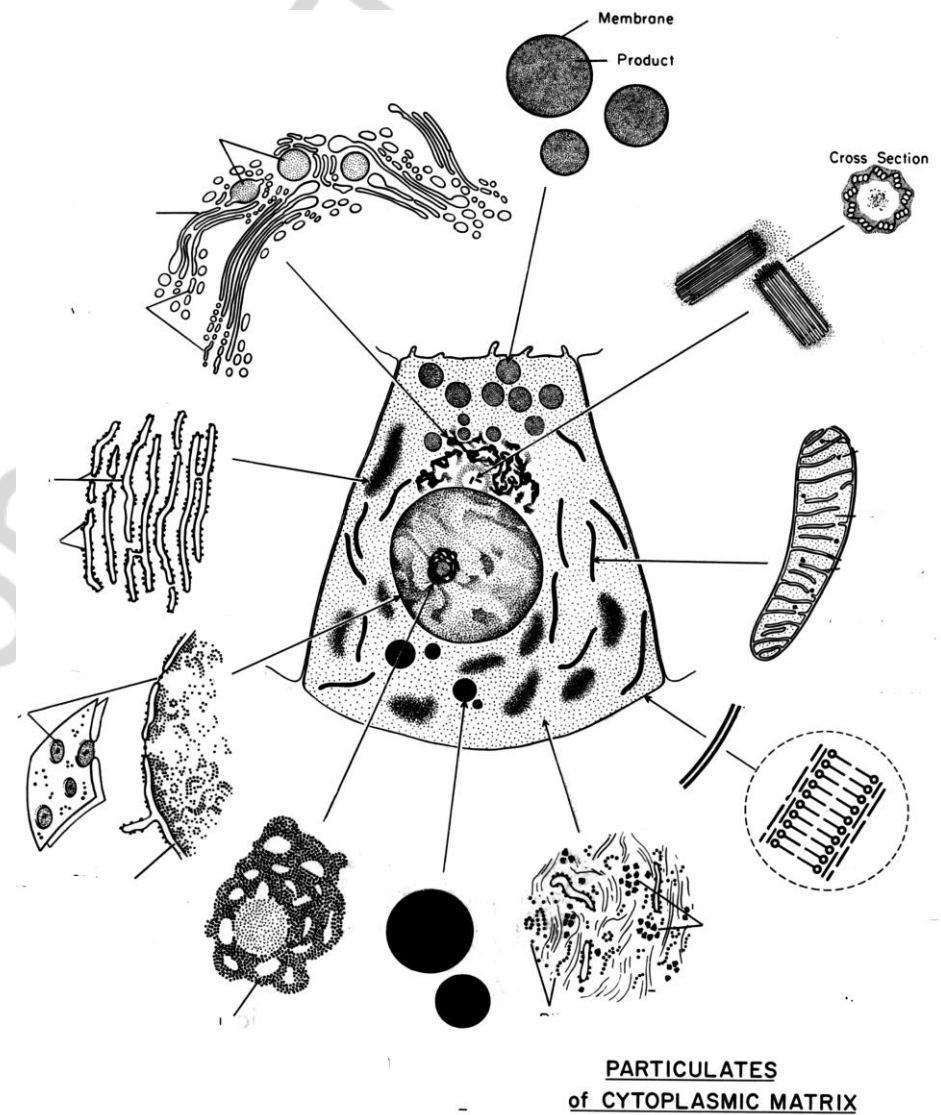
Magnification: 400×

Draw and designate:

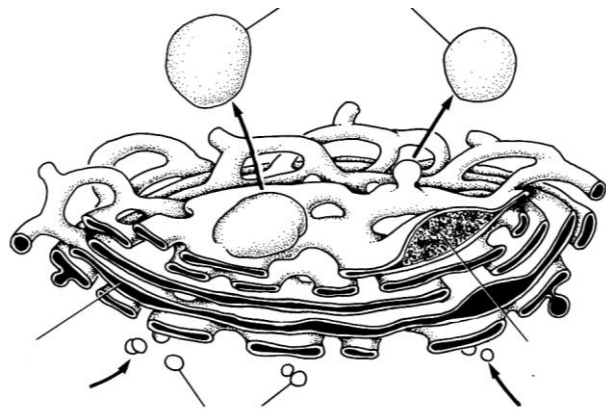
- 1 — nucleus (basophilic staining);
- 2 — cytoplasm (oxyphilic staining)

- 6 — mitochondrion;
- 7 — nucleus;
- 8 — cell center;
- 9 — hyaloplasm;
- 10 — nucleolus;
- 11 — nuclear pores.

Task 4. SCHEME OF EUKARYOTIC CELL STRUCTURE



Task 5. DIAGRAM of GOLGI COMPLEX



Designate:

- 1 — cis face;
- 2 — trans face;
- 3 — Golgi saccules;
- 4 — transfer vesicles;
- 5 — secretory granules.

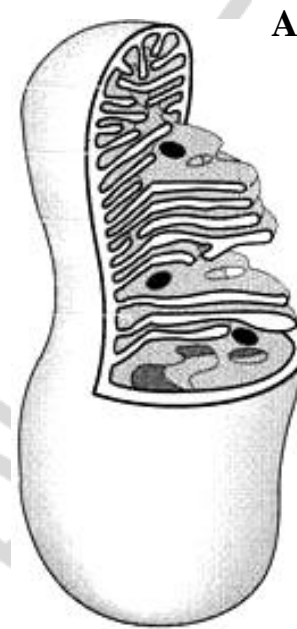
Task 6. GOLGI COMPLEX IN THE SPINAL GANGLION NERVE CELLS

Staining: Impregnation with osmic acid
Magnification: 400×

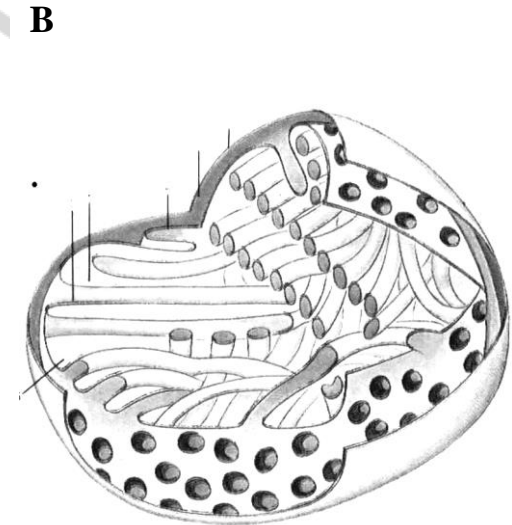
Draw 1–2 nerve cells and designate:

1 — nucleus of neuron; 2 — cytoplasm; 3 — Golgi complex.

Task 7. DIAGRAM OF MITOCHONDRIA



A

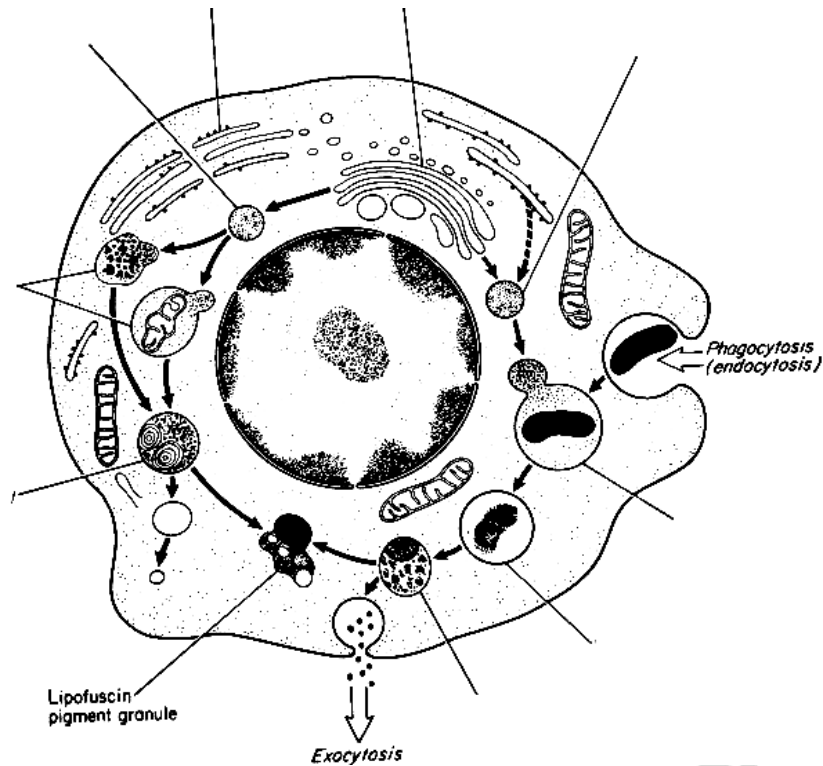


B

Designate: mitochondria with plate (A) and tubular (B) cristae:

- 1 — outer membrane;
- 2 — inner membrane;
- 3 — cristae;
- 4 — matrix;
- 5 — matrix granule.

Task 8. LYSOSOMES, PHAGOLYSOSOMES AND MULTIVESICULAR BODIES



Designate:

1 — primary lysosome; 2 — endoplasmic reticulum; 3 — Golgi complex;
4 — phagolysosome; 5 — autophagosome; 6 — residual body.

Correct tasks № _____

Lecturer _____

Task 9. LIPID INCLUSIONS IN HEPATIC CELLS

Staining: Osmic acid

Magnification: 400×

Draw a cell and designate:

1 — cell nucleus; 2 — lipid inclusions.

Task 10. GLYCOGEN INCLUSIONS IN HEPATIC CELLS

Staining: Karmin on Best

Magnification: 400×

Draw a cell and designate:

1 — cell nucleus;

2 — glycogen inclusions.

Topic 2. CELL MORPHOLOGY: STRUCTURAL ORGANIZATION OF CELLULAR SURFACE

Репозиторий БГМУ

1. Membrane principle of cell organization. Molecular structure of plasmatic membrane. Basic organization principles of cell membranes.
2. Free cell surface structure: glycocalyx. Submembraneous components of cells.
3. Cell receptors, their classification, and structural organization. Ion channels.
4. Types of substance transport through the plasmalemma: endocytosis, exocytosis.
5. Cytoskeleton morphology: microfilaments, microtubules, intermediated filaments.
6. The structure of special cell organelles: microvilly and cilia.
7. Morphology of cell contact surfaces. Classification and structure of intercellular contacts.

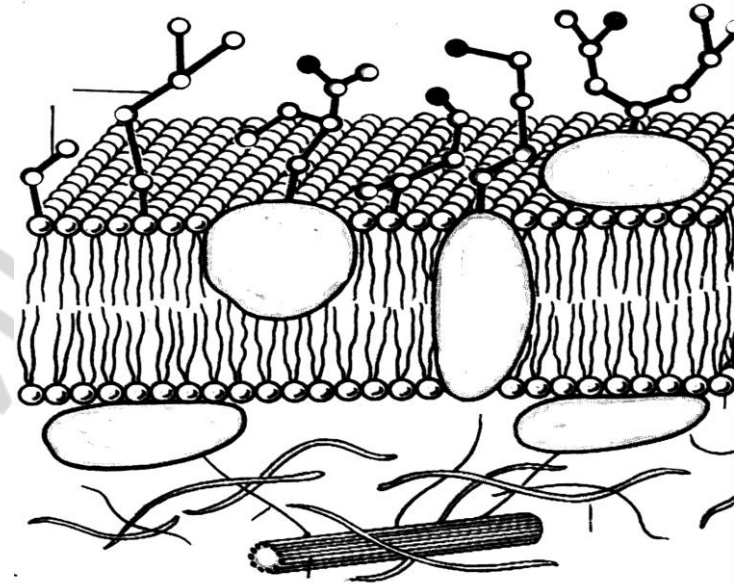
Functions of plasmalemma

1. _____
2. _____
3. _____
4. _____
5. _____

Correct tasks № _____

Lecturer _____

Task 11. SCHEME OF THE STRUCTURAL AND MOLECULAR ORGANIZATION OF PLASMATIC MEMBRANE (plasmalemma)

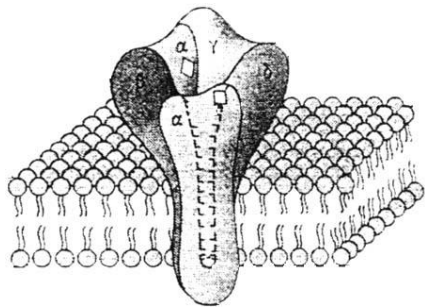
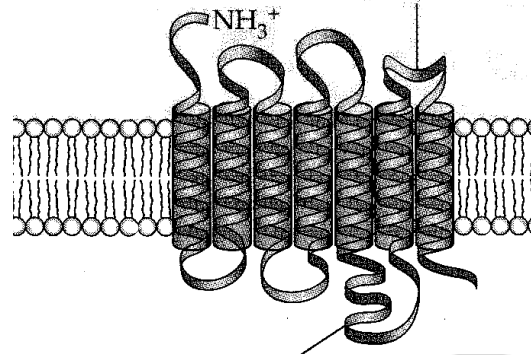
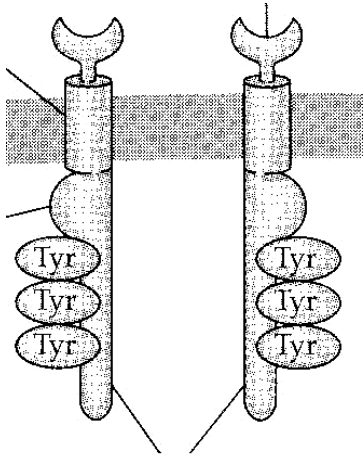


Designate:

- I — glycocalyx; II — biological membrane; III — submembrane complex.
- 1 — phospholipid bilayer;
 2 — membrane proteins: a — receptor protein, b — integral protein, c — submembrane proteins;
 3 — glycoproteins;
 4 — glycolipids;
 5 — actin microfilaments;
 6 — microtubules.

Task 12. PLASMALEMMA RECEPTORS

Definition of "Receptor" _____

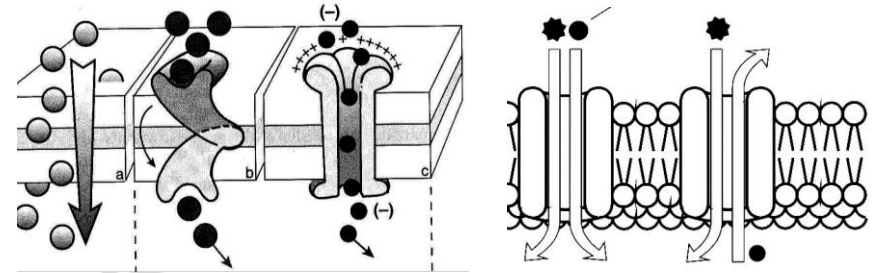


Designate in the picture:

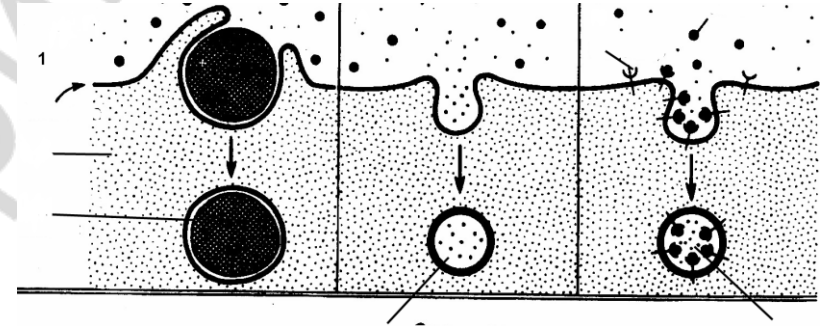
- 1 — 1-segment catalytic tyrosine-kinase receptor;
- 2 — 7-segment receptor associated with G-protein;
- 3 — acetylcholine canal-forming receptor;
- 4 — extracellular domain;
- 5 — intramembrane domain;
- 6 — intracellular domain.

Task 13. SCHEME OF TRANSPORT

I



II

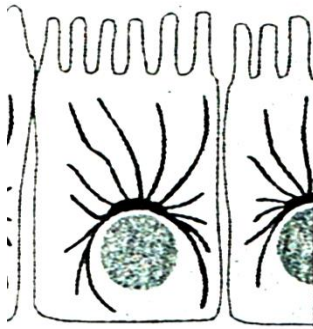


Designate:

- I** — transport of molecules through the plasma membrane: a — simple diffusion; b — carrier protein; c — channel protein; d — cotransport (symport); e — antiport.
- II** — vesicular transport: 1 — phagocytosis; 2 — pinocytosis; 3 — receptor mediated transport: a — cytoplasm; b — phagosome; c — receptor; d — ligand.

Task 14. CYTOSKELETON

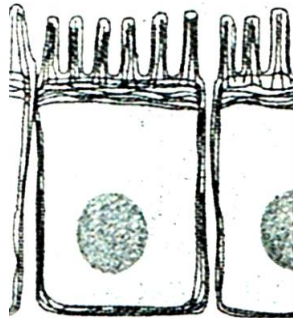
MICROTUBULES



Functions:

- intercellular transport;
- movement of chromosomes during mitosis;
- maintain cell shape;
- beating of cilia and flagella.

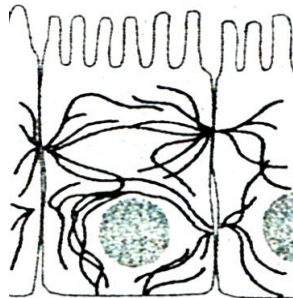
MICROFILAMENTS



Functions:

- support the cell shape;
- formation of the structural core of microvilli;
- locomotion of cells.

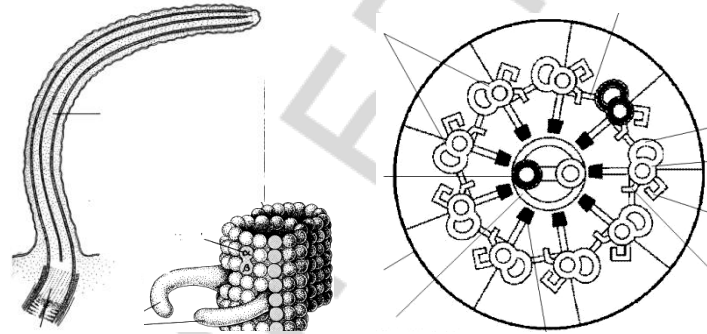
INTERMEDIATE FILAMENTS



Functions:

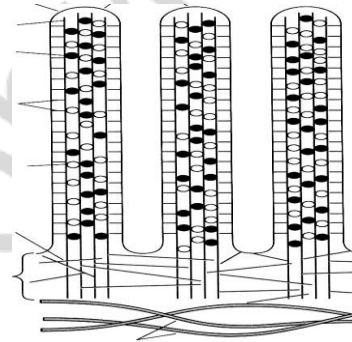
- provide structural support;
- take part in intercellular junction.

Task 15. SCHEME OF CILIA AND MICROVILLI MOLECULAR STRUCTURE



Designate:

- A** — longitudinal,
- B** — cross sections
- 1 — microtubule doublets (A and B);
- 2 — central pair of microtubules;
- 3 — dynein arms;
- 4 — basal corpuscle.



Designate:

- 1 — plasmalemma;
- 2 — actin filaments;
- 3 — cytoskeleton terminal reticulum;
- 4 — intermediate filaments.

INTERMEDIATE FILAMENTS

| Protein | Type of tissue |
|---------------------------------|----------------|
| Keratin filaments | |
| Vimentin filaments | |
| Desmin | |
| Glial fibrillary acidic protein | |

Task 16. CLASSIFICATION AND STRUCTURE OF CELL JUNCTIONS

| Groups of contacts | Types of contacts | Space between two membrane c | Function | |
|---|---|----------------------------------|---|--|
| Occluding junctions Cell – to – cell | tight junction or zonula occludens | – | non-permeable for micromolecules and ions | |
| Adhesive junctions Cell – to – cell | junction simplex junction denticulate zonula adherens desmosome or macula adherens | 15–20 nm 15–20 nm 25–30 nm | mechanical linkage of cells, permeable for micromolecules and ions | |
| Adhesive junctions Cell – to – extracellular matrix | focal adhesive hemidesmosome | | anchor the actin cytoskeleton or intermediate filament to the extracellular matrix, transducer signals from outside to the cell | |
| Communicating junctions Cell – to – cell | Gap junction: nexus synapses | 2–3 nm 20–30 nm | permeable for ions and substances with M. B. < 2000 dalton transmit impulses | |

Designate in the scheme:

1 — zonula occludens; 2 — junction denticulate; 3 — macula adherens; 4 — zonula adherens; 5 — nexus; 6 — synapses; 7 — hemidesmosome.

| | |
|--|---|
| <p>Topic 3. STAGES OF EMBRYONIC DEVELOPMENT, GAMETES, FERTILIZATION, CLEAVAGE, GASTRULATION</p> | <p>Embryology — fundamental science about developing organisms from fertilization until birth.</p> |
| <ol style="list-style-type: none"> 1. Basic periods of vertebrates' ontogenesis. 2. Germ cells. Morphological and functional characteristics. Role in transmitting genetic information. Difference from somatic cells. Classification of oocytes. 3. Basic periods of vertebrates' embryogenesis. Main processes of embryonic development. 4. Fertilization. Definition, essence, biological significance. 5. Cleavage. Definition. Interconnection between cleavage type and ovum structure. Comparative characteristics of cleavage in different vertebrates. Types and structure of blastulas. 6. Gastrulation. Definition. Types of gastrulation. 7. Organo- and histogenesis. Definition. Germ layers, their differentiation and derivatives. 8. Extraembryonic organs of vertebrates, their functions. | |
| <p><i>Definition of "Ontogenesis":</i></p> <hr/> | |
| <p><i>The main periods of ontogenesis:</i></p> <ol style="list-style-type: none"> 1. _____ 2. _____ <ol style="list-style-type: none"> a) _____ b) _____ c) _____ d) _____ 3. _____ | <p>DIFFERENCES BETWEEN GERM CELLS (GAMETES) AND SOMATIC CELLS</p> <ol style="list-style-type: none"> 1. Haploid nucleus 2. Oocyte's NCR is 1 : 500 sperm's NCR is 1 : 0.5 somatic cells have NCR 1 : 6 3. Depressed metabolism 4. Necessity of protection and nutrition 5. High specialization. |

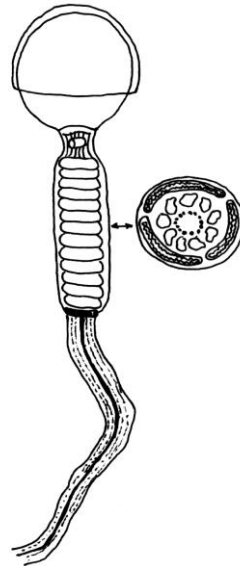
Task 17. SPERMATOZOON STRUCTURE

Preparation: Spermatozoa of a guinea pig
Staining: Iron hematoxylin
Magnification: 400×

Draw and designate:

- A** — head:
1 — acrosome;
2 — nucleus;
B — tail:
3 — neck;
4 — middle piece;
5 — principal piece;
6 — end piece.

Task 18. SCHEME OF HUMAN SPERMATOZOON STRUCTURE
(under the electron microscope)



Designate:

- 1 — cytoplasmic membrane;
2 — acrosome;
3 — nucleus;
4 — neck;
5 — mitochondria;
6 — centriole;
7 — circular fibrils.

Task 19. OOCYTE STRUCTURE

Preparation: Mammal ovum
Staining: Hematoxylin-eosin
Magnification: 400×

Draw and designate:

- 1 — nucleus of oocyte;
2 — cytoplasm of oocyte;
3 — oolemma;
4 — zona pellucida;
5 — follicular cells of corona radiata.

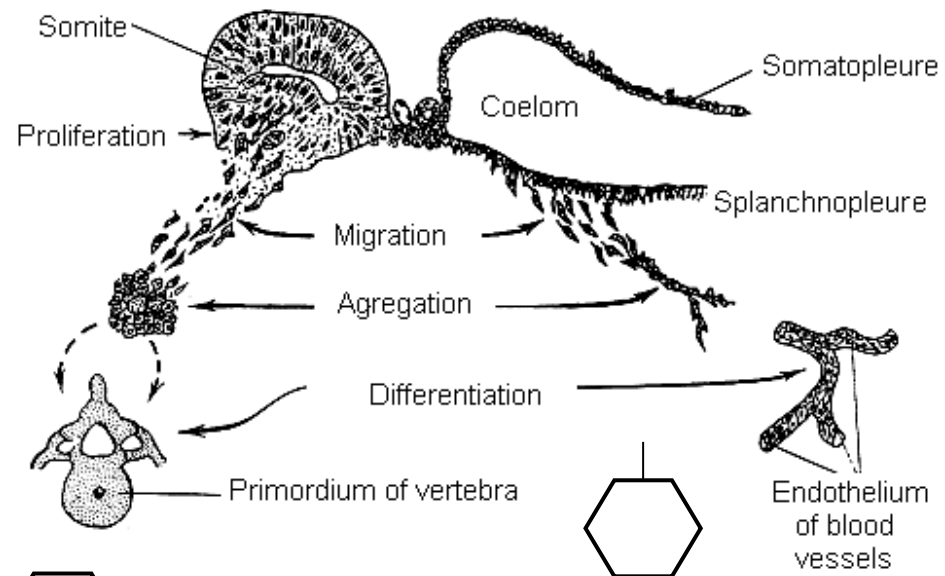
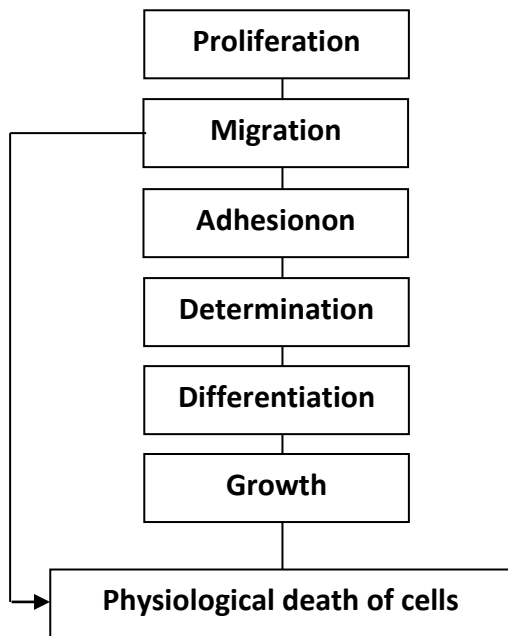
Task 20. SCHEME OF OOCYTE STRUCTURE
(under the electron microscope)



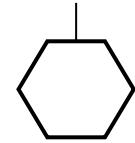
Designate:

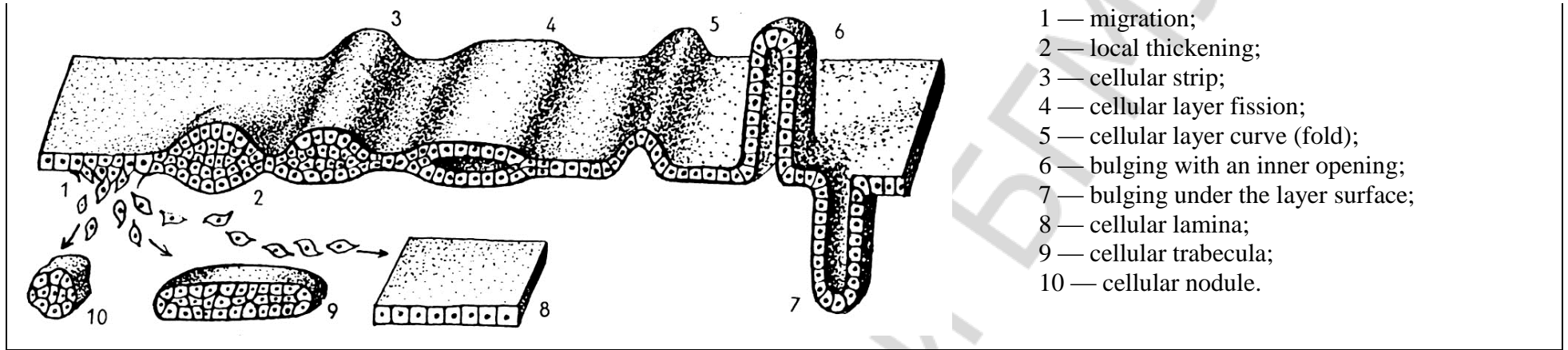
- 1 — nucleus;
2 — cytolemma;
3 — cortical granules;
4 — yolk granules;
5 — zona pellucida;
6 — spermatozoon receptors;
7 — follicular epithelium (corona radiata).

Task 21. BASIC PROCESSES OF EMBRYONIC DEVELOPMENT



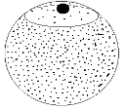
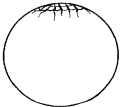

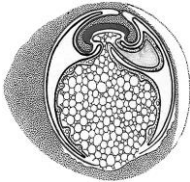
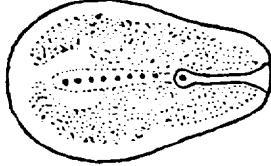

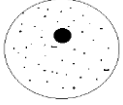

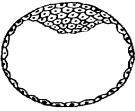



Designate:
 A — an example of primordial formation by cell migration;
 B — an example of form formation by cellular layer modification:





Task 22. COMPARATIVE CHARACTERISTIC OF VERTEBRATE EMBRYOGENESIS

| | Oocyte | Cleavage | Blastula | Extraembryonic organs | Neurula | Gastrulation |
|------------|------------------|-------------------------|-----------|-----------------------|---------|--------------|
| Incraniate | <p>1. 2.</p> | <p>3. 4. 5.</p> | <p>6.</p> | | | |
| Amphibia | <p>1. 2.</p> | <p>3. 4. 5.</p> | <p>6.</p> | | | |
| Fish | <p>1. 2.</p> | <p>3. 4. 5.</p> | <p>6.</p> | | | |

| | | | | | | |
|---------|---|---|--|---|---|---|
| Birds |  1. 2. |  3. 4. 5. |  6. |  |  |  |
| Mammals |  1. 2. |  3. 4. 5. |  6. |  |  |  |

Based on: 1 — yolk amount, 2 — yolk distribution, 3 — coverage of zygote material,
4 — similarity of blastomere size, 5 — cleavage synchronization; 6 — blastula names,
7 — types of gastrulation.

Topic 4. EARLY STAGES IN HUMAN EMBRYONIC DEVELOPMENT

Correct tasks № _____

Lecturer _____

1. Microscopic and ultramicroscopic structure of human germ cells. Progenesis.
2. Stages of human embryonic development, their duration.
3. Human fertilization. Fertilization stages.
4. Human cleavage. Its essence. Structure of the blastocyst.
5. Human gastrulation. Embryonic disc. Primitive node and primitive streak.
6. Formation of germ layers and axial organs.
7. Differentiation of the germ layers; tissue derivatives.

Definition of “Fertilization”: _____

Definition of “Cleavage”: _____

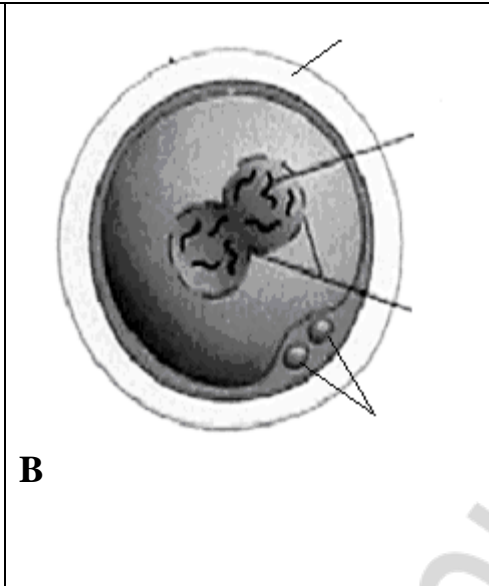
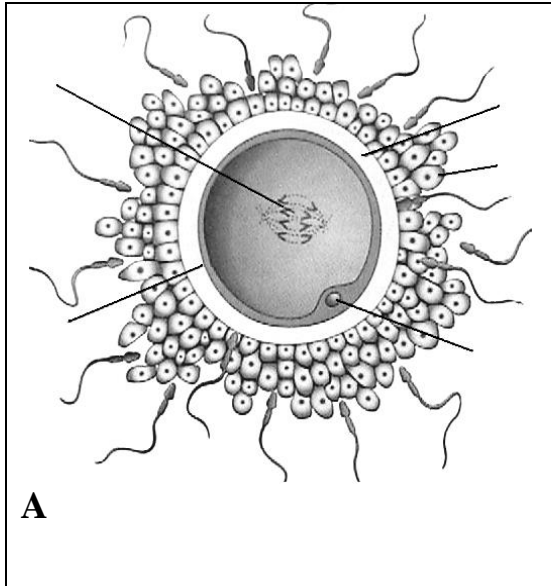
Definition of “Gastrulation”: _____

Mechanisms of histogenesis and organogenesis:

1. Proliferation, growth and death of cells
2. Migration and adhesion of cells
3. Cells interaction
4. Determination
5. Differentiation

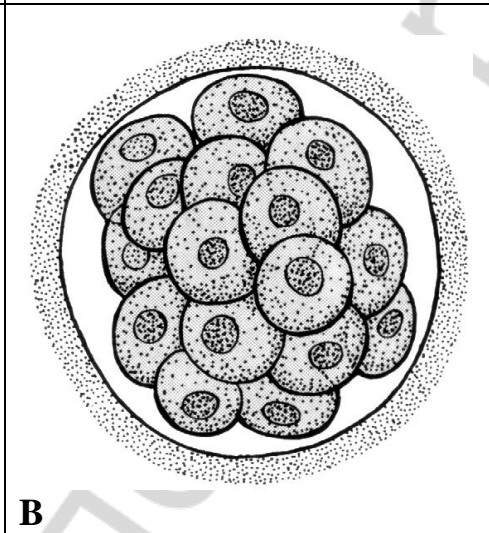
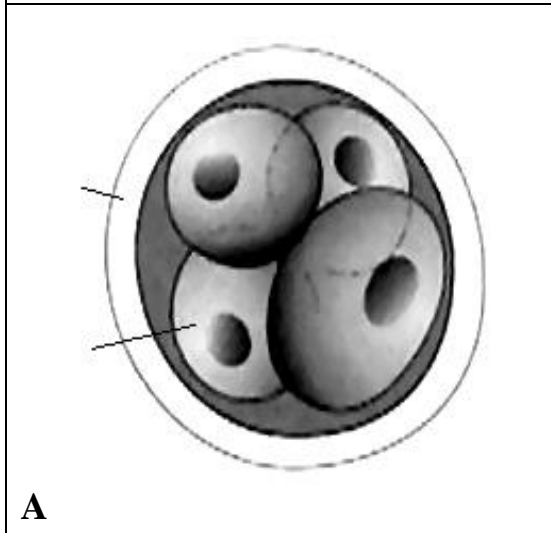
Definition of “Determination”:

Definition of “Differentiation”:



Designate:
 A — contact interaction phase; B — synkarionic phase.
 1 — chromosomes;
 2 — oolemma;
 3 — nuclear membrane;
 4 — polar bodies;
 5 — zona pellucida;
 6 — follicular cells of corona radiata;
 7 — tunic fertilization.

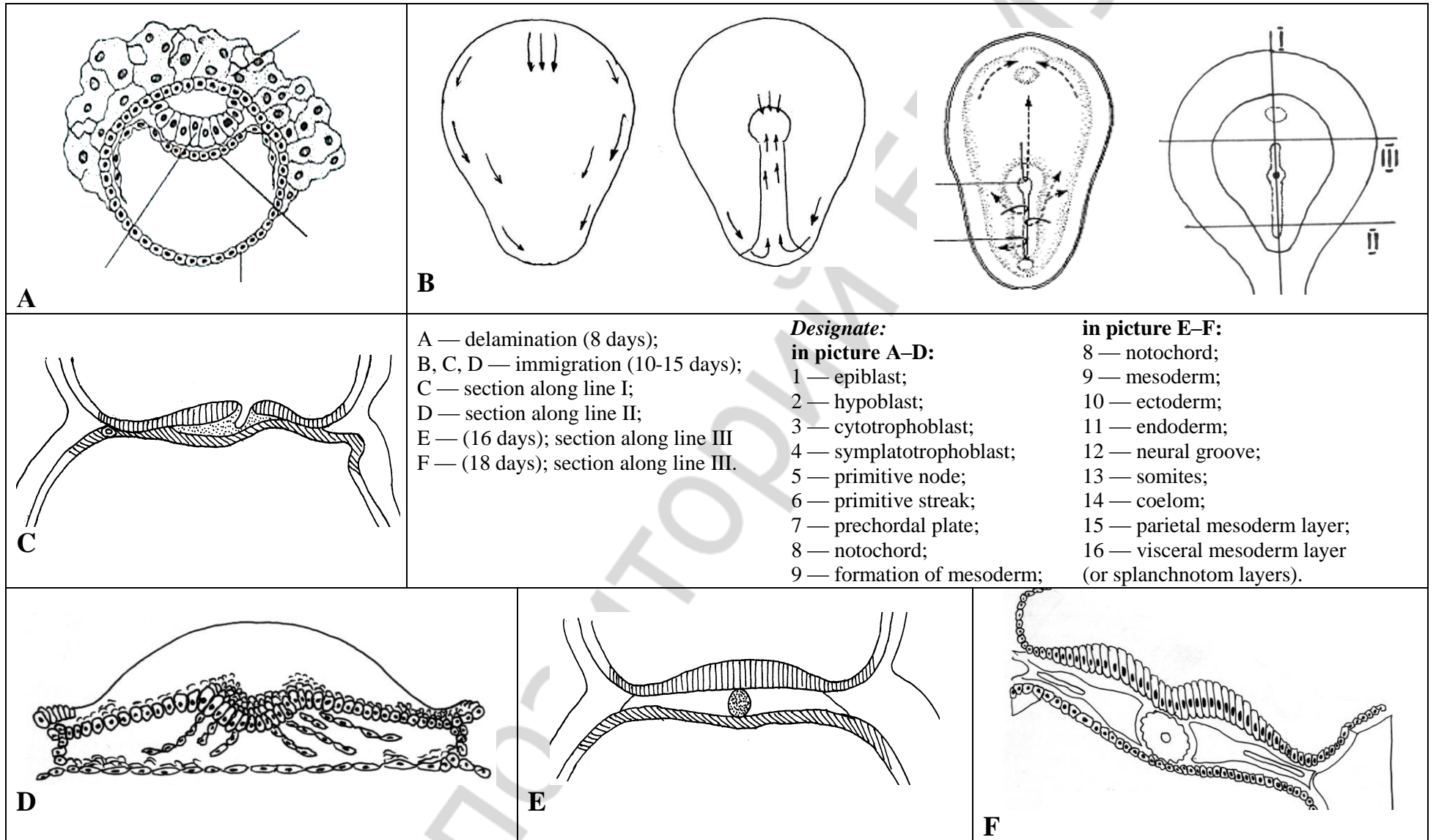
Task 24. CHARACTERISTICS OF CLEAVAGE
Based on:
 – the coverage of zygote material _____
 – the similarity of blastomere size _____
 – cleavage synchronization _____



Task 25. CLEAVAGE
Designate:
 A — four-cell stage;
 B — morula;
 C — blastocyst.

1 — blastomeres;
 2 — tunic fertilization;
 3 — embryoblast;
 4 — trophoblast;
 5 — blastocyst cavity.

Task 26. GASTRULATION



Task 27. SOMITES, NOTOCHORD, NERVE TUBE OF CHICKEN'S EMBRYO

Staining: Hematoxylin
Magnification: 80×, 400×

Designate:

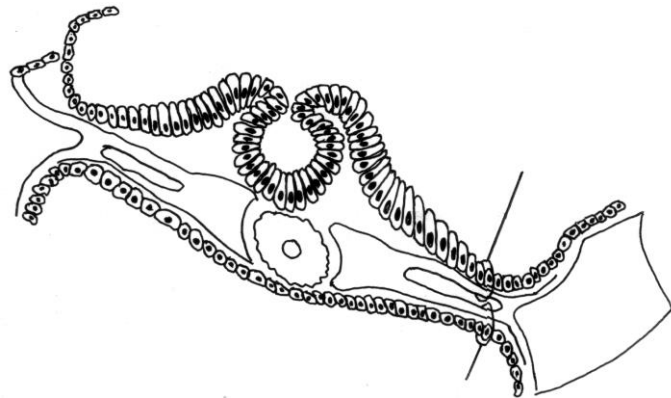
1 — neural tube; 2 — ectoderm; 3 — notochord; 4 — somite;
5 — nephrotome; 6 — splanchnotome (or mesoderm) parietal layer;
7 — splanchnotome (or mesoderm) visceral layer; 8 — coelom; 9 — endoderm.

Task 28. NEURULATION. FORMATION OF THE PRIMITIVE GUT AND THE EMBRYONIC BODY.

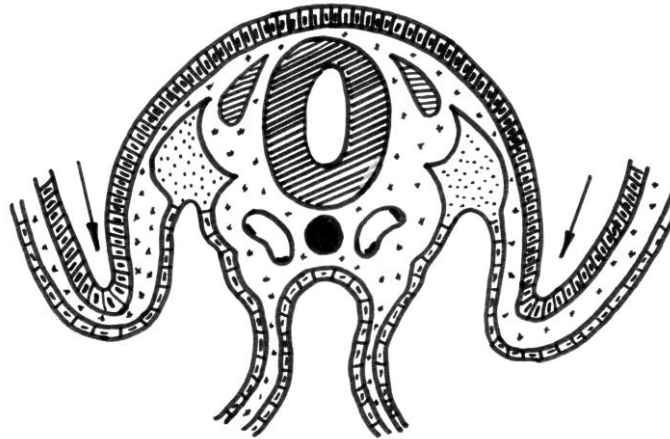
Designate:

1 — neural tube; 2 — spinal ganglia; 3 — notochord; 4 — ectoderm; 5 — somite; 6 — nephrogonotome (6a — somatopleure); 7 — parietal mesoderm or splanchnotome layer (7a — splanchnopleure); 8 — visceral mesoderm or splanchnotome layer; 9 — coelom; 10 — endoderm; 11 — forming primitive gut; 12 — primary vessels.

A



B



A — closure of neural tube
(21st day);

B — formation of embryonic
body and primary gut
(22^d-23^d days)

Colour:

Ectoderm — in green;

Endoderm — in red;

Mesoderm and its derivatives —
in blue;

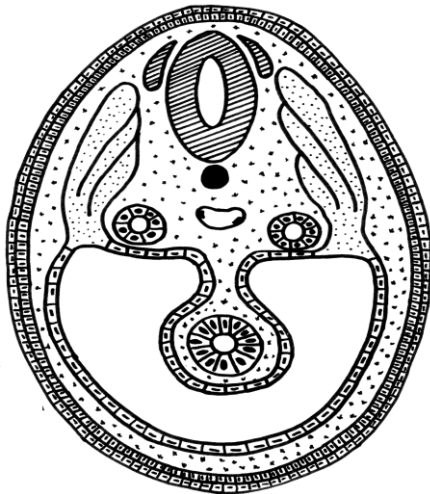
Notochord — in brown;

Neural tube and ganglia —
in yellow.

Task 29. CROSS-SECTION OF HUMAN EMBRYO AT THE 8th-9th WEEK OF DEVELOPMENT

Designate and colour:

- 1 — neural tube (in yellow);
- 2 — spinal ganglia (in yellow);
- 3 — notochord (in brown);
- 4 — ectoderm (in green);
- 5 — somites: a — dermatome; b — myotome;
- c — sclerotome (in blue);
- 6 — nephrogonotome (in blue);
- 7 — parietal mesoderm layer (in blue);
- 8 — visceral mesoderm layer (in blue);
- 9 — coelom;
- 10 — mesenchyme;
- 11 — endoderm (in red);
- 12 — primary vessels.



Task 30. DIFFERENTIATION OF EMBRYONIC LAYERS

Write the names of embryonic layers and their derivatives, *learn* the origin of different tissue types.

| | | |
|-------------|--------------------------|--|
| I. | | Nervous tissue Epithelial tissue (stratified: epidermis and it's gland, oral cavity and it's glands, anus) |
| II. | | Epithelial tissue (simple columnar in GIT) |
| III. | III A | Epithelial (simple squamous = mesothelium, secretory epithelium of suprarenal cortex) Cardiac muscle tissue |
| | III B | Epithelial tissue of kidney and gonads (simple cuboidal) |
| | III C — — — | Connective tissue of skin Skeletal muscular tissue Skeletal connective tissue (bone, cartilage) |
| | III D | Blood, endothelium Connective tissue Smooth muscular tissue |

Correct tasks № _____

Lecturer _____

Topic 5. EPITHELIAL TISSUES

1. Tissue as one of the levels of cellular organization. Definition of the term “tissue”. Classification of tissues, regeneration, changeability and interaction of tissues.
2. Morphological, functional and histogenetic properties of epithelial tissues.
3. Morphofunctional and histogenetic classifications of epithelia.
4. Covering epithelia: structure of different types of epithelia.
5. Glandular epithelium: structure and classifications of exocrine glands. Properties of endocrine glands.
6. Characteristics of the secretory process. Types of secretion.

Definition of the term “Tissue”: _____

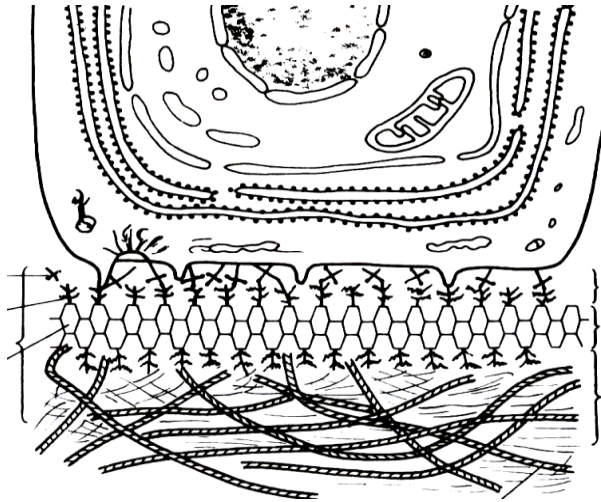
The basic types of tissues:

- 1.
- 2.
- 3.
- 4.

The main property of every type of tissue:

- 1.
- 2.
- 3.
- 4.

Task 31. SCHEME OF MOLECULAR ORGANIZATION OF BASEMENT MEMBRANE



Designate:

- 1 — lamina lucida;
- 2 — lamina densa;
- 3 — reticular lamina;
- 4 — collagen fibrils;
- 5 — laminin;
- 6 — proteoglycan;
- 7 — type IY collagen.

Task 32. SIMPLE SQUAMOUS EPITHELIUM (MESOTHELIUM)

Staining: Impregnation with nitrogenous acidic silver-hematoxylin
Magnification: 400×



B

Designate:

A — cross-section of mesothelium:

1 — basement membrane;

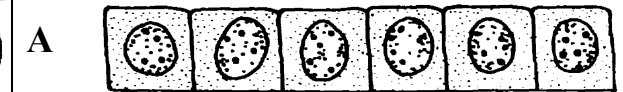
Draw and designate:

B — portion of total preparation:

- 2 — cell borders;
- 3 — cytoplasm;
- 4 — nuclei;
- 5 — stomatas.

Task 33. SIMPLE CUBOIDAL EPITHELIUM OF RENAL TUBULES

Staining: Hematoxylin-eosin
Magnification: 400×



B

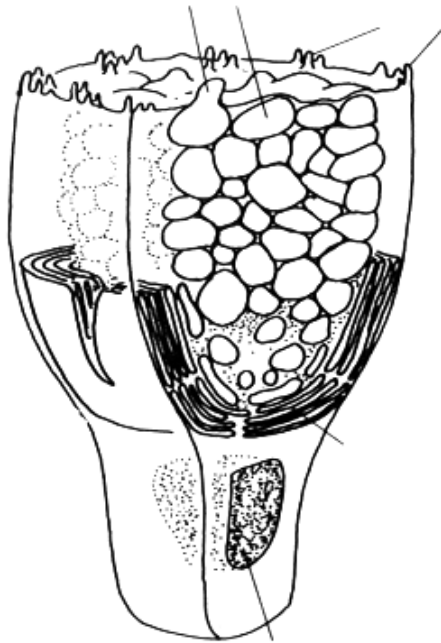
A — simple cuboidal epithelium;

Draw and designate:

B — renal tubule:

- 1 — cell borders;
- 2 — nuclei;
- 3 — cytoplasm;
- 4 — basement membrane.

Task 34. STRUCTURE OF GOBLET CELL



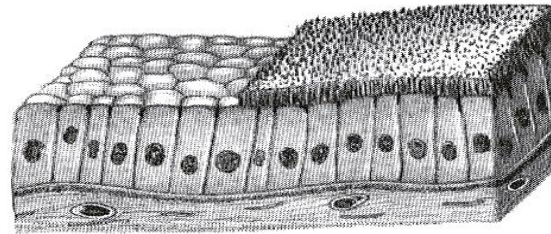
Designate:

- 1 — basal part of cell;
- 2 — apical part of cell;
- 3 — nucleus
- 4 — microvilli;
- 5 — secretory vesicles;
- 6 — Golgi apparatus.

Task 35. SIMPLE COLUMNAR INTESTINAL EPITHELIUM

Staining: Hematoxylin-eosin
Magnification: 400×

A



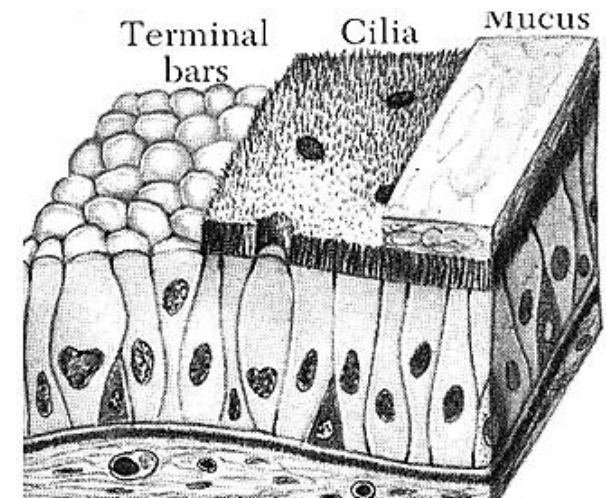
B

Draw intestinal epithelium and designate in scheme (A) and picture (B):

- 1 — microvilli (border);
- 2 — columnar cells;
- 3 — basement membrane.

Task 36. PSEUDOSTRATIFIED CILIATED EPITHELIUM OF TRACHEA

Staining: Hematoxylin-eosin
Magnification: 400×



Designate:

- 1 — ciliated cells;
- 2 — cilia;
- 3 — intermediate cells;
- 4 — goblet cells;
- 5 — basement membrane.

**Task 37. STRATIFIED SQUAMOUS
NONKERATINIZED EPITHELIUM
OF EYE CORNEA**

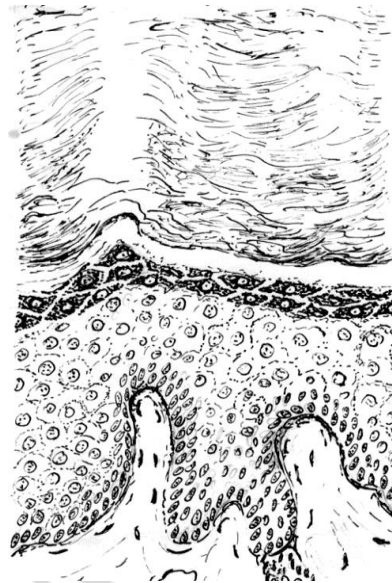
Staining: Hematoxylin-eosin
Magnification: 400×

Designate:

- 1 — basement membrane;
- 2 — basal layer;
- 3 — intermediate layer;
- 4 — flattened surface layer;
- 5 — germinal layer.

**Task 38. STRATIFIED SQUAMOUS
KERATINIZED EPITHELIUM
OF FINGER'S SKIN**

Staining: Hematoxylin-eosin
Magnification: 80×

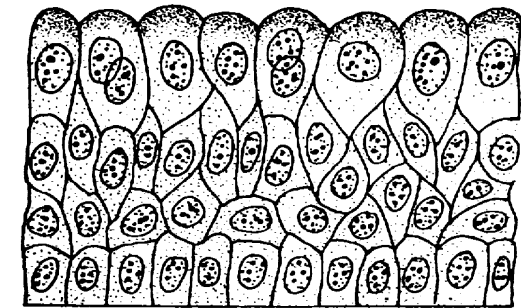
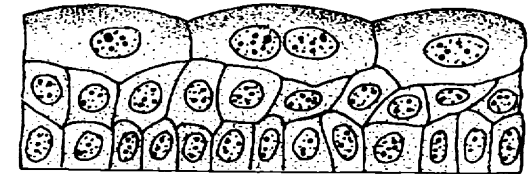


Designate:

- 1 — basement membrane;
- 2 — stratum basale;
- 3 — stratum spinosum;
- 4 — stratum granulosum;
- 5 — stratum lucidum;
- 6 — stratum corneum;
- 7 — granules in the stratum granulosum cells.

**Task 39. STRATIFIED
TRANSITIONAL EPITHELIUM
OF URINARY BLADDER**

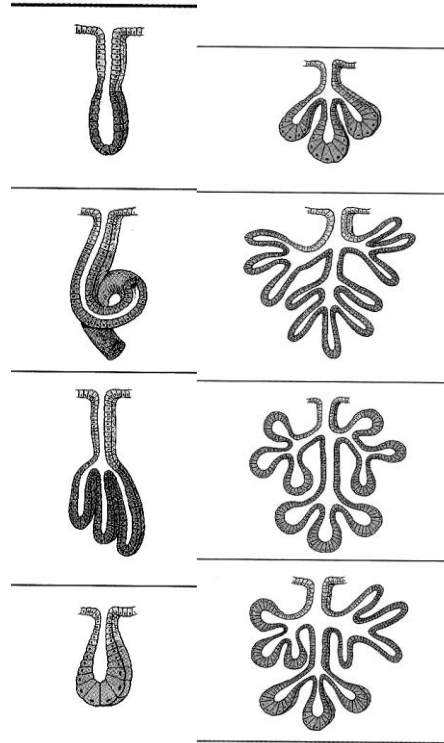
Staining: Hematoxylin-eosin
Magnification: 400×



Designate:

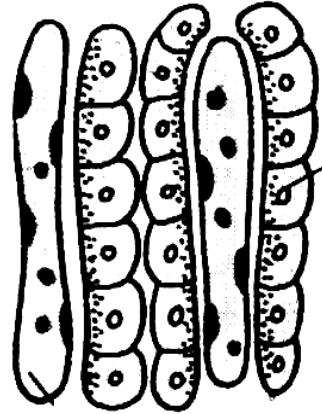
- A — epithelium in the stretched state;
B — epithelium in the non-distended state:
- 1 — basement membrane;
 - 2 — basal cells;
 - 3 — intermediate cells;
 - 4 — surface cells.

Task 40. GIVE A FULL NAME OF THE EXOCRINE GLANDS

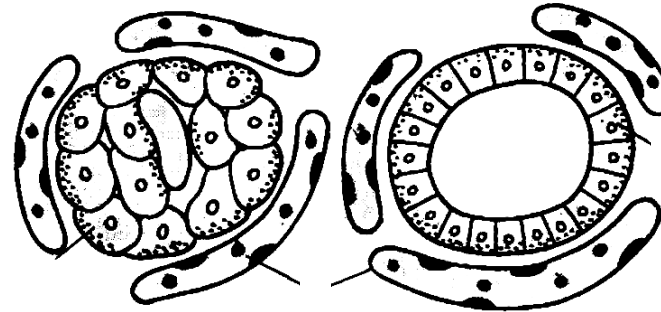


- | | |
|----|----|
| 1. | 5. |
| 2. | 6. |
| 3. | 7. |
| 4. | 8. |

Task 41. IDENTIFY MORPHOLOGICAL TYPES OF THE ENDOCRINE GLANDS



A

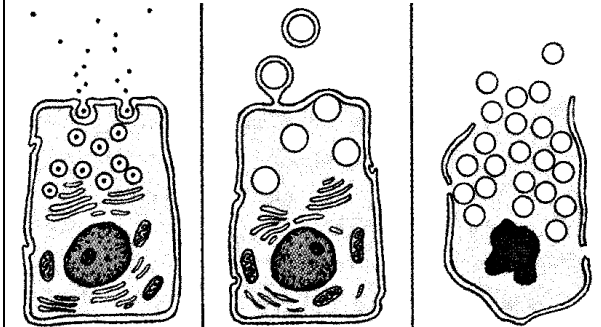


B

Designate:

1 — secretory cells; 2 — capillaries.

Task 42. DESIGNATE THE TYPE OF SECRETION



1 – Merocrine

2 – Apocrine

3 – Holocrine

Correct tasks № _____

Lecturer _____

Date « ____ » _____

Topic 6. BLOOD AND LYMPH

1. Blood and lymph as types of inner tissues.
2. Functions of blood and lymph.
3. General morphology of blood. Cells of blood, their classification.
4. Erythrocytes: shape, size, structural peculiarities, function, life span.
5. Leucocytes: classification, shape, size, structure, function, life span.
6. Thrombocytes: shape, size, structure, function, life span.
7. Hemogramme. Hematocrit. Leukocyte formula, shift of blood formular to the left.

Functions of blood:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

Hemogramme

| Findings | Value |
|---------------|--|
| Hematocrit | 0,35–0,55 |
| Hemaglobin | 120–140 g/l |
| Erythrocytes | F — $3,9–4,9 \times 10^{12}/l$ M — $4,7–5,2 \times 10^{12}/l$ |
| Reticulocytes | 0,6–0,8 % |
| Leucocytes | $3,8–9,8 \times 10^9/l$ |
| Thrombocytes | $200–400 \times 10^9/l$ |
| ESR | 3–8 mm/h |

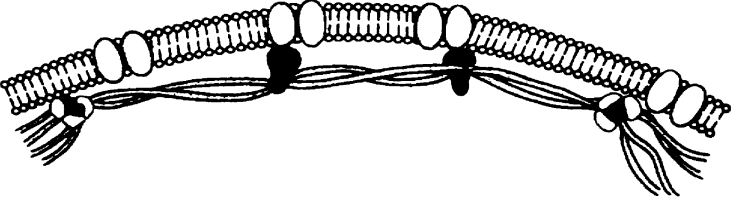
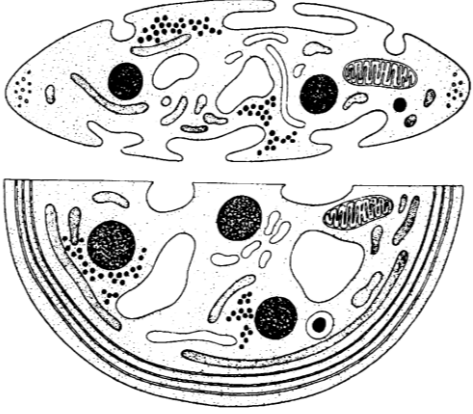
Leukocyte formula (%)

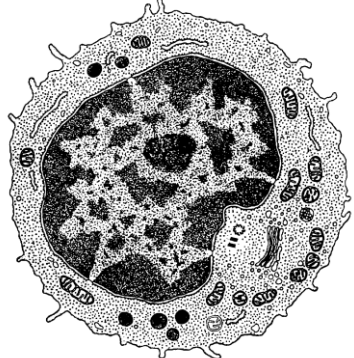
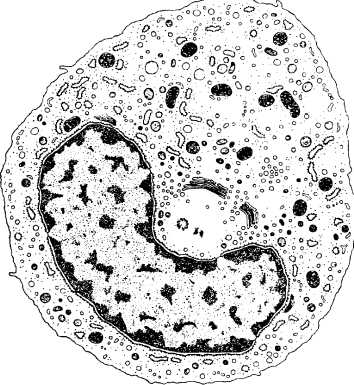
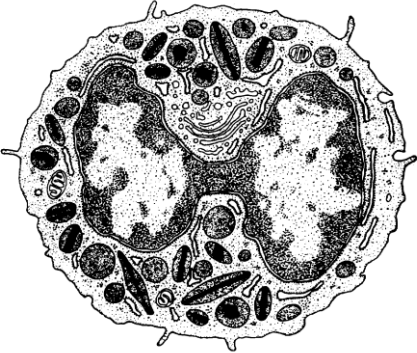
| | | | | |
|-------------|---------|---------|--------|--|
| Neutrophils | Totally | 65–70 | | |
| Among them: | Y-ng. | band-n. | Segm-n | |
| | 0–1 | 1–4 | 60–70 | |
| Eosinophils | | 1–5 | | |
| Basophils | | 0–1 | | |
| Lymphocytes | | 20–40 | | |
| Monocytes | | 6–8 | | |

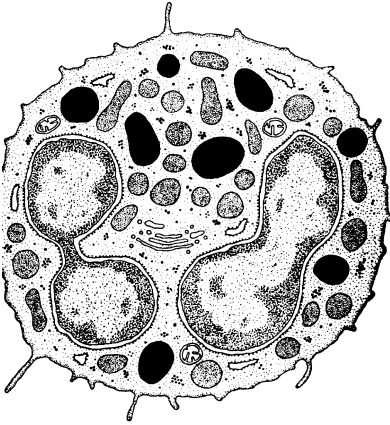
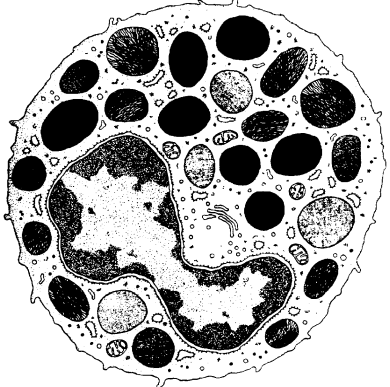
Task 43. CELLS OF HUMAN BLOOD

Staining: Hematoxylin-eosin

Magnification: 400×

| Blood cells | | Size, functions | MEMBRANE AND CYTOSKELETON OF ERYTHROCYTE | |
|------------------------------|--|---|--|-------------------|
| Erythrocyte | | | <p>Designate: 1 — basic transmembraneous protein; 2 — spectrin; 3 — actin; 4 — stabilizing protein; 5 — ankyrin.</p>  | |
| Thrombocyte (blood platelet) |  | <p>Designate: 1 — granules; 2 — glycogen; 3 — border membraneous tubules; 4 — circular bands of microtubules; 5 — tubules of dense tubular reticulum; 6 — mitochondria</p> | Thrombocytes in blood smear | Size and function |

| | | | | |
|---------------------------------|--|--|----------------------------|------------------------|
| <p>Lymphocyte agranulocyte</p> |  | <p>Designate: 1 — nucleus; 2 — lysosomes; 3 — ribosomes; 4 — microvilli.</p> | <p>Lymphocyte in smear</p> | <p>Size, function</p> |
| <p>Monocyte agranulocyte</p> |  | <p>Designate: 1 — nucleus; 2 — lysosomes; 3 — vacuoles; 4 — centrioles.</p> | <p>Monocyte in smear</p> | <p>Size, function</p> |
| <p>Eosinophil (granulocyte)</p> |  | <p>Designate: 1 — nucleus; 2 — specific granules; 3 — crystalloid; 4 — pseudopodia. Granules contain: 1. 2. 3. 4.</p> | <p>Eosinophil in smear</p> | <p>Size, functions</p> |

| | | | | |
|------------|--|--|--|--|
| Neutrophil |  | <p>Designate: 1 — nucleus; 2 — specific granules; 3 — azurophilic granules; 4 — glycogen; 5 — pseudopodia.</p> <p>Specific granules contain:</p> <ol style="list-style-type: none"> 1. 2. 3. | <p>Neutrophils in smear: a — young; b — band; c — segmented</p> | Size, function |
| Basophil |  | <p>Designate: 1 — nucleus; 2 — specific granules.</p> <p>Specific granules contain:</p> <ol style="list-style-type: none"> 1. 2. 3. 4. 5. | Basophil in smear | Size, functions <div data-bbox="1509 1203 2089 1374" style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Correct tasks № _____</p> <p>Lecturer _____</p> </div> |

Topic 7. FORMATION OF BLOOD CELLS (HEMOPOIESIS)

1. Modern theory of hemopoiesis. Hemopoietic stem cell. Differones and hemopoietines.
2. Embryonic hemapoiesis in the yolk sac, liver, thymus, spleen, lymph nodes, red bone marrow.
3. Erythropoiesis.
4. Granulopoiesis.
5. Monocytopoiesis. Mononuclear phagocytic system.
6. Lymphopoiesis (antigen independent) in central lymphoid organs. T- and B-lymphocyte systems. Cellular and humoral immunity.
7. Lymphopoiesis in peripheral lymphoid organs, its dependence on antigen activity.
8. Cell cooperative interactions in immune response.

Task 44. DEVELOPMENT STAGES OF HEMOPOIESIS IN HUMAN BEINGS



Age of the fetus (in terms of months)

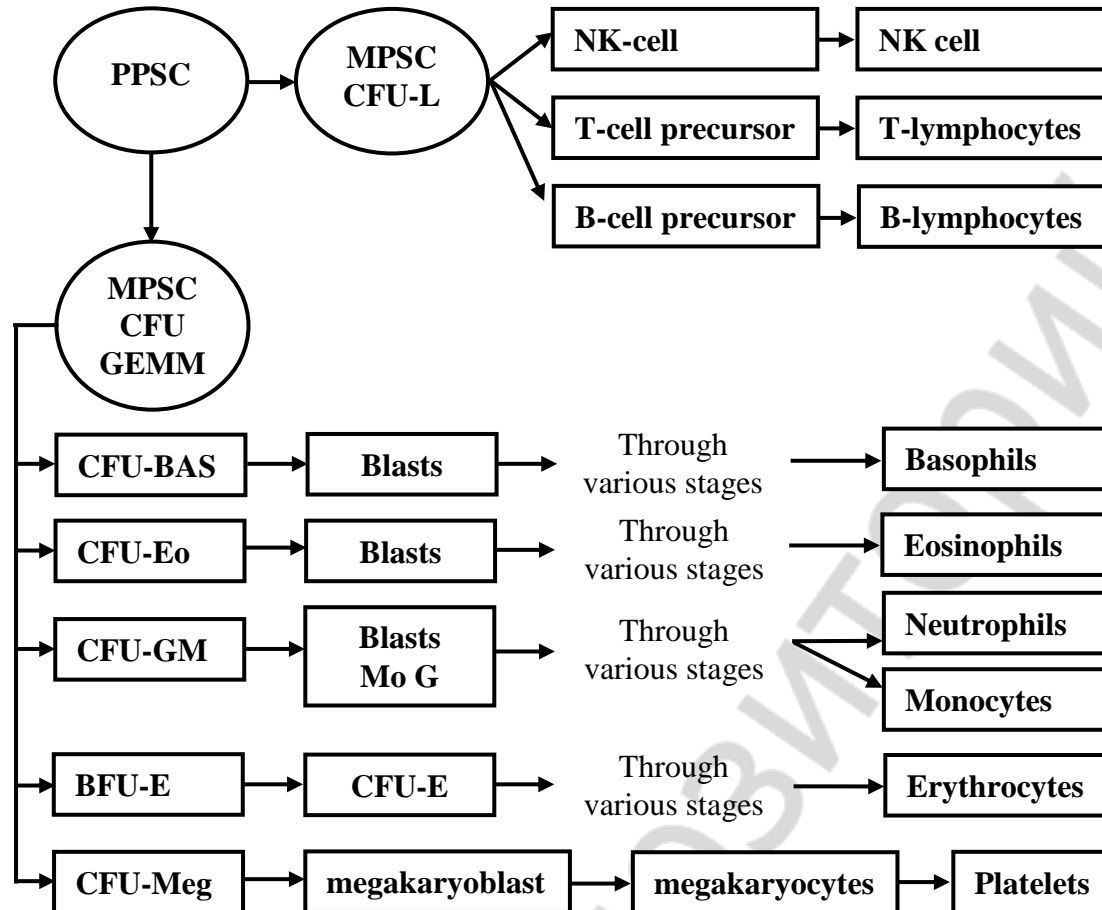
Color different periods of hemopoiesis:

mesoblastic stage – **in yellow**; hepatic stage – **in green**; myeloid stage – **in red**.

Basic characteristics of embryonic stages of hemopoiesis

| Stage | Organ | Duration | Cells |
|-----------|--|---|---|
| Mesoblast | Wall of the yolk sac. Intravascular | From 2 nd to 9 th week of gestation | Stem cells, primary erythrocytes — megalocytes, leukocytes |
| | Liver Extravascular | From 6 th week to before the birth | Stem cells. Predominant erythrocytes, thrombocytes, granulocytes |
| Hepatic | Spleen Extravascular | From 7 th week to the birth | All blood cell. Before the birth only Ly |
| | Thymus Extravascular | From 7 th week of gestation — throughout life | T lymphocyte |
| Myeloid | Red bone marrow | From 12 week of gestation — throughout life | All blood cells except T lymphocytes |

Task 45. SCHEME OF HAEMOPOIESIS



I class — PPSC pluripotential haemopoietic stem cell.

II class — hemistem hemapoietic cell:
 MPSC CFU-L — multipotential lymphoid stem cell;
 MPSC CFU-GEMM — multipotential myeloid stem cell.

III class — CFU-Bas — colony-forming units basophils

CFU-Eo — colony-forming units eosinophils;

CFU-GM — colony-forming units neutrophils, monocytes;

BFU-E burst — forming units erythrocytes;

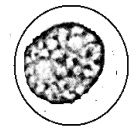
CFU-Meg — colony-forming units megakaryocytes.

IV class — blasts.

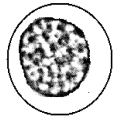
V class — immature cells.

V1 class — mature cells

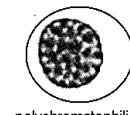
Task 46. SCHEME OF ERYTHROPOIESIS



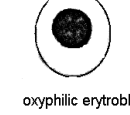
proerythroblast



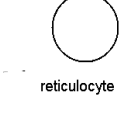
basophilic erythroblast



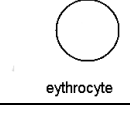
polychromatophilic erythroblast



oxyphilic erythroblast



reticulocyte



erythrocyte

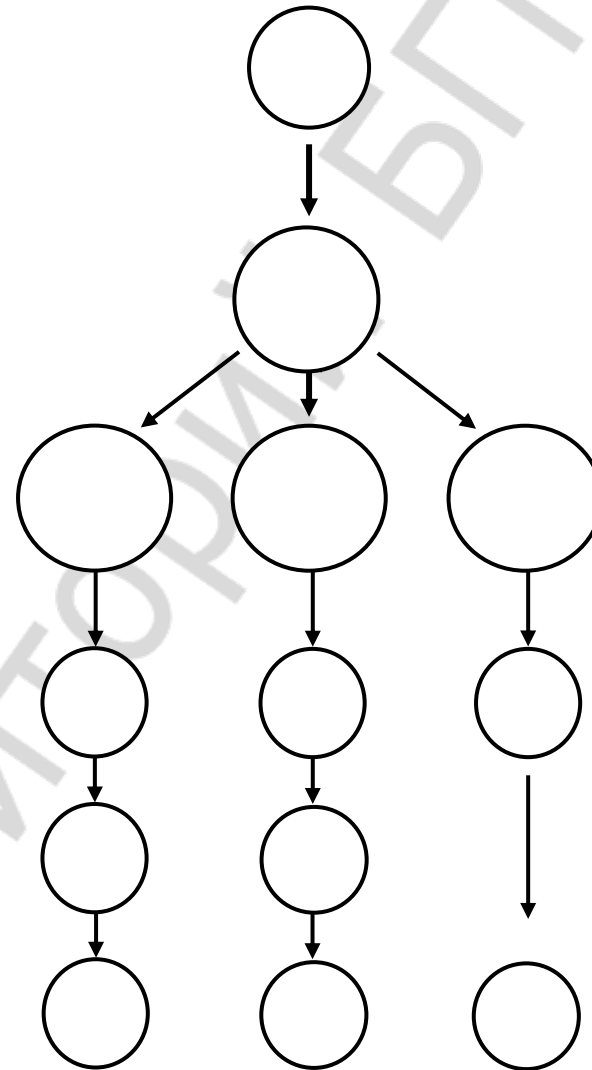
Draw cytoplasm in color and designate:

- 1 — differentiating cells;
- 2 — maturing cells;
- 3 — mature cell.

Write the main characteristic of erythropoiesis:

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

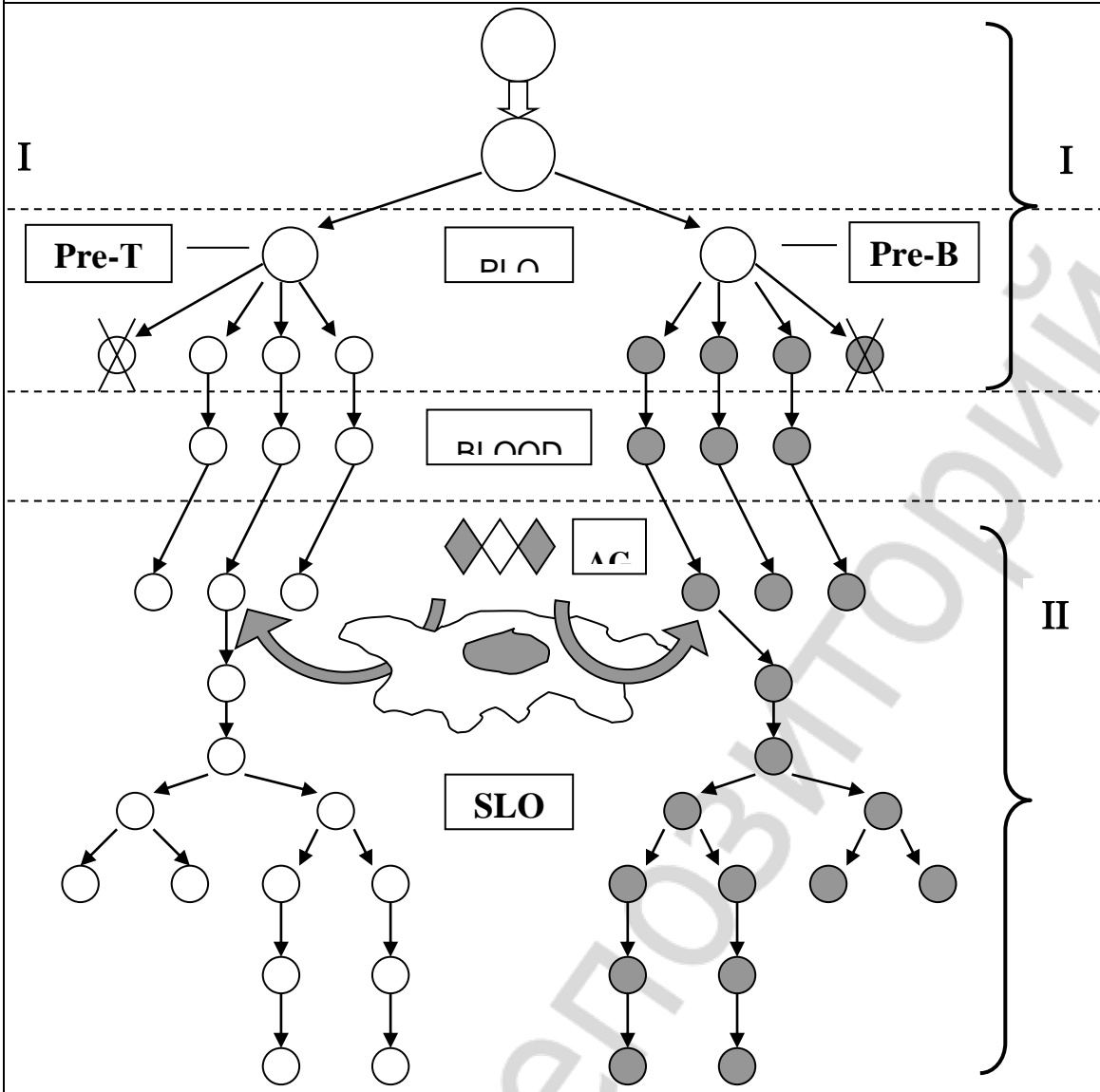
Task 47. SCHEME OF GRANULOPOIESIS



Draw the cell and write their name:

- I. Blast cell — myeloblast;
- II. Differentiating cells:
 - 1 — promyelocytes;
 - 2 — myelocytes;
- III. Maturing cells:
 - 3 — metamyelocytes;
 - 4 — band cells.
- IV. Mature cell:
 - 5 — neutrophil;
 - 6 — eosinophil;
 - 7 — basophil.

Task 48. SCHEME OF LYMPHOPOIESIS



I — antigen independent differentiation

II — antigen dependent differentiation

AG — antigens

Pre-T — precursor T-lymphocyte cells

Pre-B — precursor B-lymphocyte cells

CLO — primary (central) lymphoid organs

PLO — secondary (peripheral) lymphoid organs

Designate:

1 — stem hemapoietic cell;

2 — hemi-stem hemapoietic cell;

3 — antigens;

4 — macrophage;

5 — T-lymphocytes;

6 — B- lymphocytes;

7 — memory cells;

8 — effector T-lymphocytes;

9 — plasmatic cells;

10 — banned clones of lymphocytes

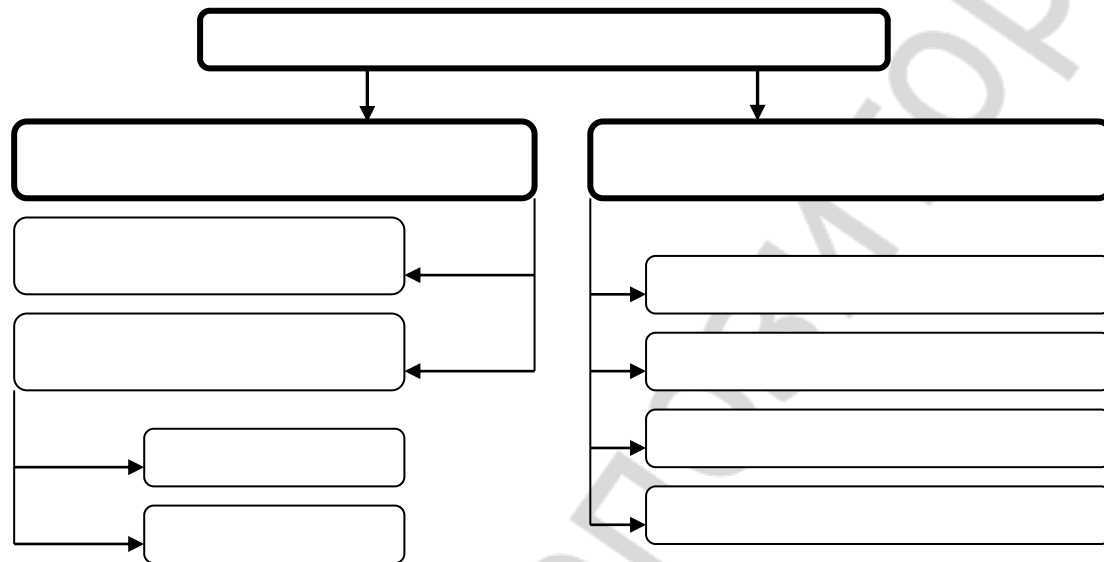
Correct tasks № _____

Lecturer _____

Topic 8. CONNECTIVE TISSUES

1. Mesenchyma (origin, localization, morphological and functional characteristics), its derivatives.
2. General characteristics and classification of connective tissues.
3. Development, structure and functions of loose connective tissue.
4. Characteristics of loose connective tissue cells.
5. Formation and structure of intercellular substance of loose connective tissue.
6. System of mononuclear phagocytes.
7. Specialized connective tissue.
8. Structure and functions of dense connective tissues.

Classification of connective tissues



Task 49. ORGANIZATION OF CONNECTIVE TISSUE

Cells:

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

INTERCELLULAR SUBSTANCE

Fibers:

- 1.
- 2.
- 3.

Ground (amorphous) substance:

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

}
}
}

**Task 50. MESENCHYMA
IN EMBRYON SECTION**

Staining: Hematoxylin-eosin
Magnification: 400×

Draw and designate:

- 1 — mesenchymal cells nuclei;
- 2 — mesenchymal cells processes;
- 3 — intercellular substance;
- 4 — blood vessel.

**Task 51. LOOSE CONNECTIVE
TISSUE**

Staining: Ferrous hematoxylin
Magnification: 400×

Draw and designate:

- 1 — collagen fiber;
- 2 — elastic fiber;
- 3 — ground substance;
- 4 — fibroblast;
- 5 — macrophage;
- 6 — lymphocyte;
- 7 — mast cell nucleus;
- 8 — granules in mast cell cytoplasm;
- 9 — mast cell degranulation.

**Task 52. STRUCTURAL ORGANIZATION
OF COLLAGENOUS AND ELASTIC FIBERS**

Aminoacids are taken up
by cell and linked to form

↓
PRO- α - CHAINS

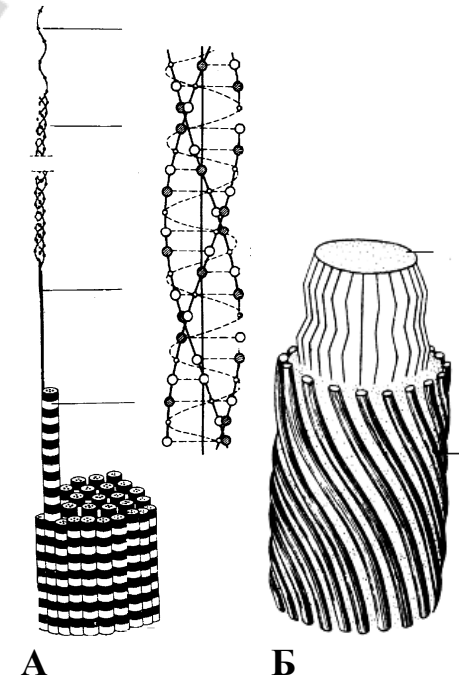
↓
PROCOLLAGEN
MOLECULE

↓
Such molecules leave
the cell through secretory
vacuoles to form

↓
TROPOCOLLAGEN
MOLECULES

↓
Which aggregate to form

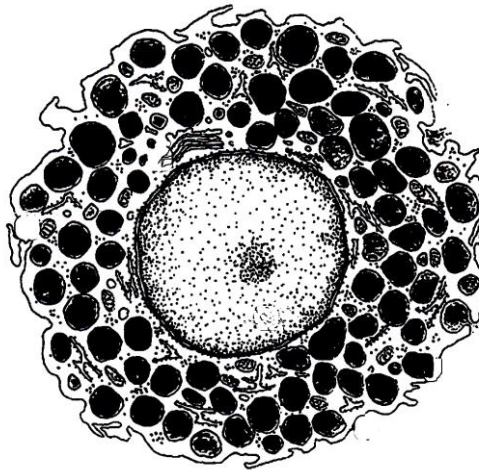
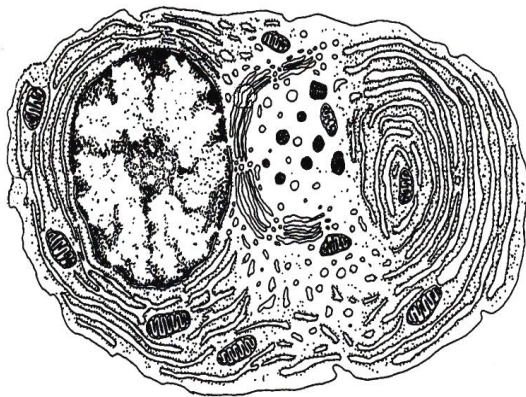
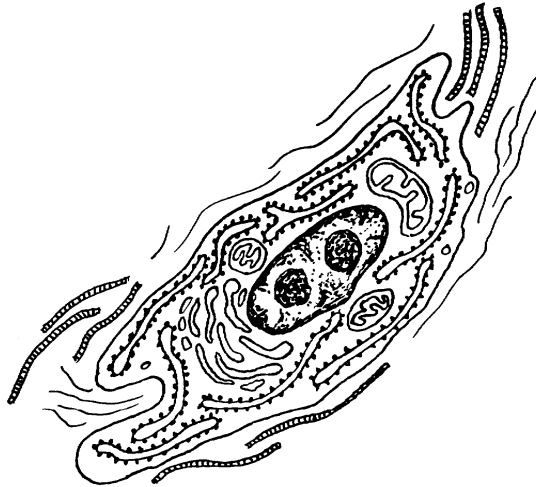
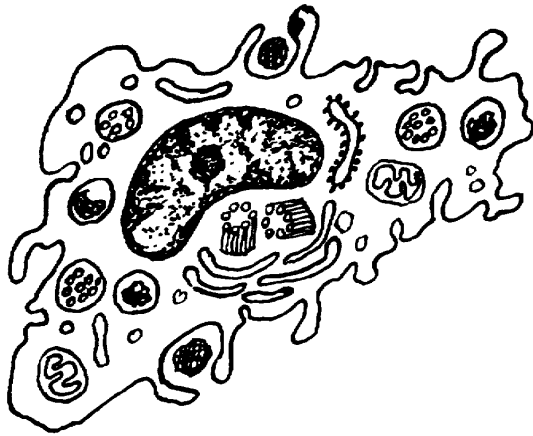
↓
COLLAGEN FIBERS



Designate:

- A: 1 — polypeptide chain;
- 2 — tropocollagen;
- 3 — microfibrils;
- 4 — striated fibril;
- 5 — collagenous substance;
- 6 — spiral structure of collagen micromolecule.
- B: 7 — elastin; 8 — microfibrils.

Task 53. ULTRASTRUCTURE OF LOOSE IRREGULAR CONNECTIVE TISSUE CELLS



Designate:

I — fibroblast:

- 1 — granular endoplasmatic reticulum;
- 2 — complex Golgi;
- 3 — collagen and elastic fiber.

Name:

precursor cell _____

cellular function _____

II — macrophage (histiocyte):

- 1 — lysosome;
- 2 — phagosome;
- 3 — pinocytotic vesicles.

Name:

precursor cell _____

cellular function _____

III — plasmocyte:

- 1 — numerous rER;
- 2 — Golgi complex.

Name:

precursor cell _____

cellular function _____

IV — Mast cell (labrocyte):

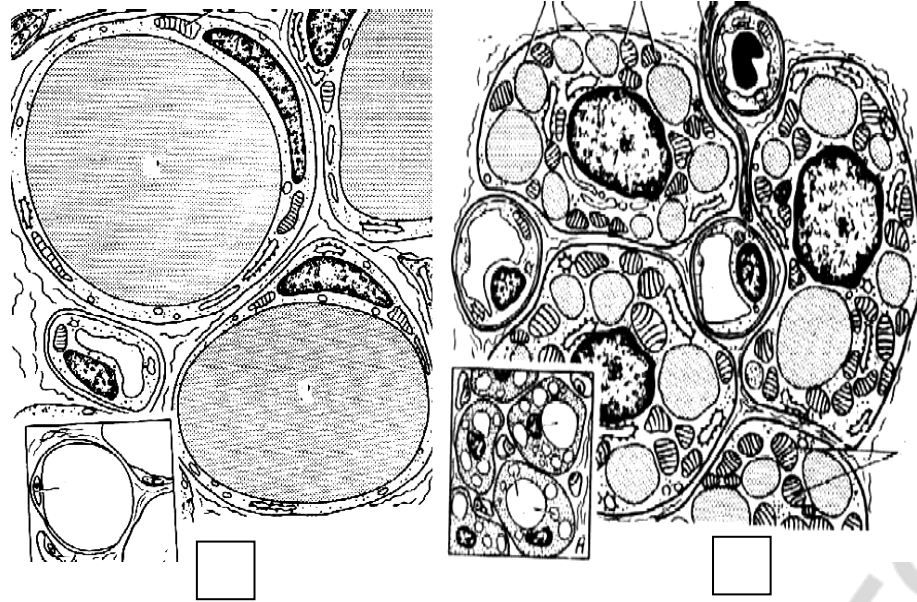
- 1 — heterogenous granules with heparine and histamine.

Name:

precursor cell _____

cellular function _____

Task 54. ADIPOSE TISSUE



Designate:

A — white adipose tissue; **B** — brown adipose tissue

- 1 — adipocyte;
- 2 — adipocyte nucleus;
- 3 — fat droplets;
- 4 — mitochondria;
- 5 — blood capillaries;
- 6 — nerve fiber.

Correct tasks № _____

Lecturer _____

Task 55. WHITE ADIPOSE TISSUE

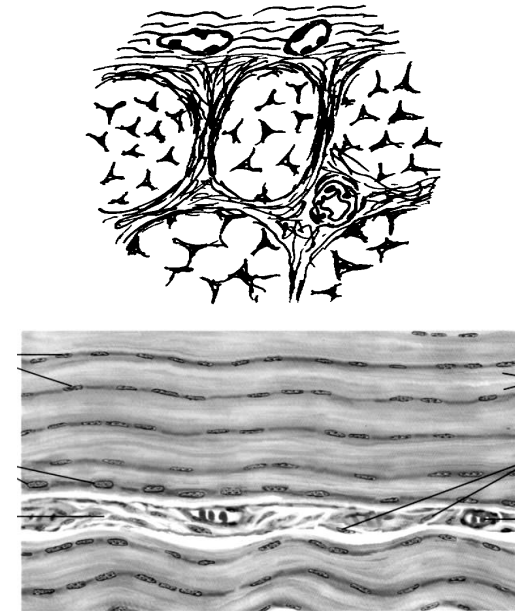
Staining: Sudan III
Magnification: 400×

Draw 3–4 cells and designate:

- 1 — adipocyte nucleus;
- 2 — fat droplet.

Task 56. DENSE REGULARLY CONNECTIVE TISSUE OF THE TENDON

Staining: Hematoxylin-eosin
Magnification: 400×



A — cross-section;
B — longitudinal section

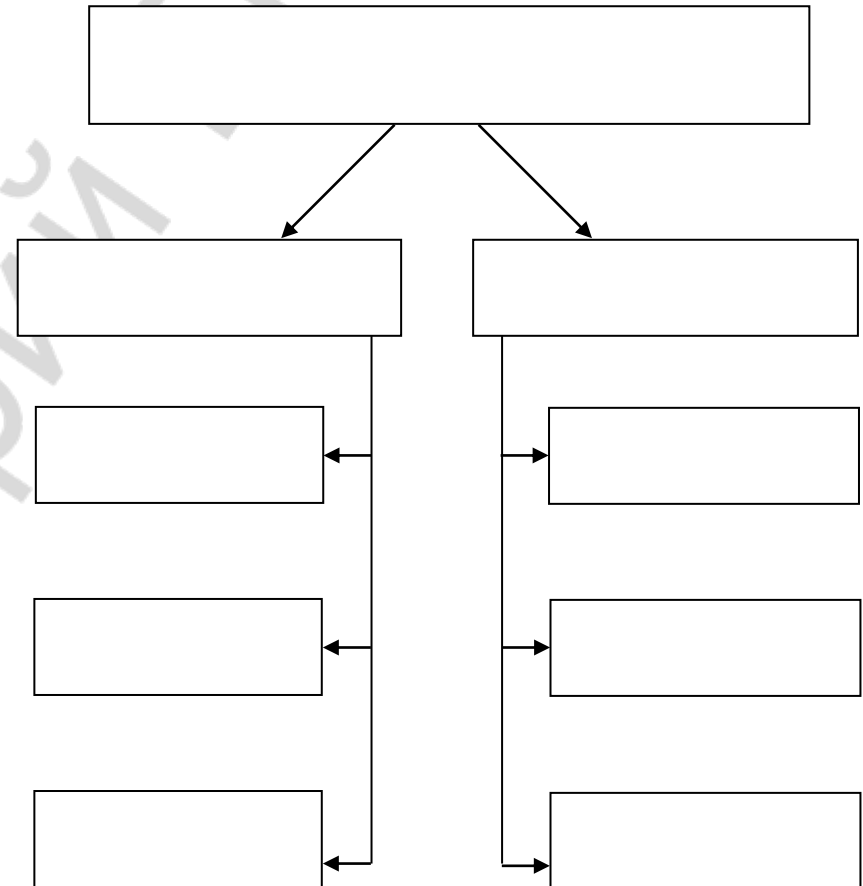
Color and designate in the picture and scheme:

- 1 — 1st level bands; 2 — 2nd level bands;
- 3 — fibrocytes; 4 — endotenoneum;
- 5 — peritenoneum; 6 — blood vessels.

Topic 9. CARTILAGE AND BONE TISSUES

1. General morphological and functional characteristics, classification of cartilage tissues.
2. Structural peculiarities of different cartilage tissue types.
3. Development, growth, regeneration and age-related changes of cartilage as an organ.
4. General morphological and functional characteristics and classification of bone tissues. Bone as an organ. Periosteal structure and function.
5. Structure of reticularfibrous (woren, immature) bone tissue: cells, intercellular substance.
6. Structure of lamellar (mature) bone tissue. Compact and spongy (cancellous) bone substance.
7. Development of bone tissue (direct and indirect osteogenesis).

Task 57. CLASSIFICATION OF SKELETAL TISSUE



Task 58. HYALINE CARTILAGE

Staining: Hematoxylin-eosin

Magnification: 400×

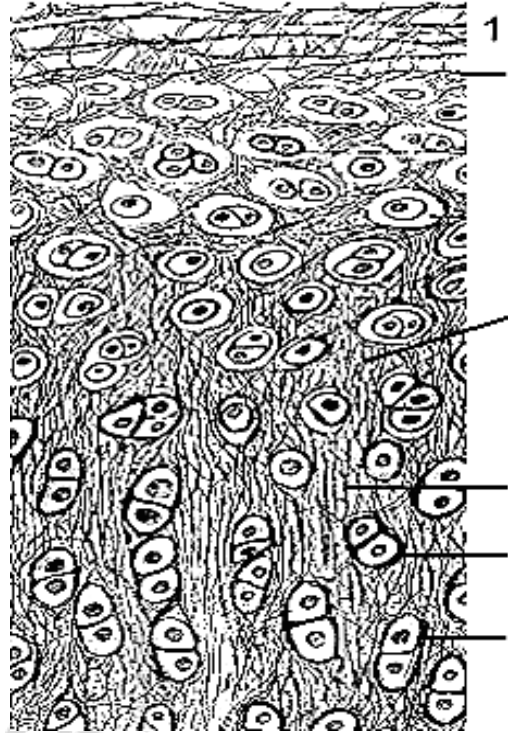
Draw and designate:

- 1 — perichondrium;
- 2 — chondroblasts;
- 3 — chondrocytes;
- 4 — isogenous groups of cells;
- 5 — intercellular substance;
- 6 — basophilic area of intercellular substance.

Task 59. ELASTIC CARTILAGE

Staining: Hematoxylin-orsein

Magnification: 400×



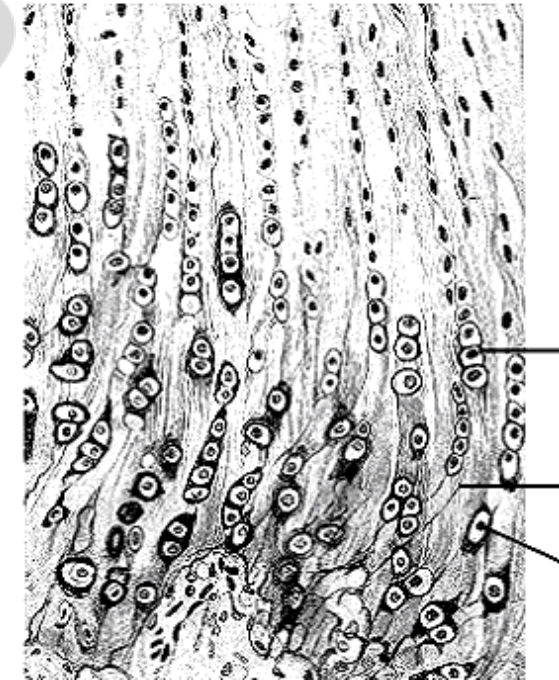
Designate:

- 1 — perichondrium;
- 2 — chondroblasts;
- 3 — chondrocytes;
- 4 — isogenous groups of cells;
- 5 — elastic fibers of intercellular substance.

Task 60. FIBROUS CARTILAGE

Staining: Hematoxylin-eosin

Magnification: 400×



Designate:

- 1 — chondrocytes;
- 2 — isogenous groups of cells;
- 3 — collagen fibers.

**Task 61. INTRAMEMBRANOUS
OSSIFICATION (DIRECT OSTEOGENESIS)**

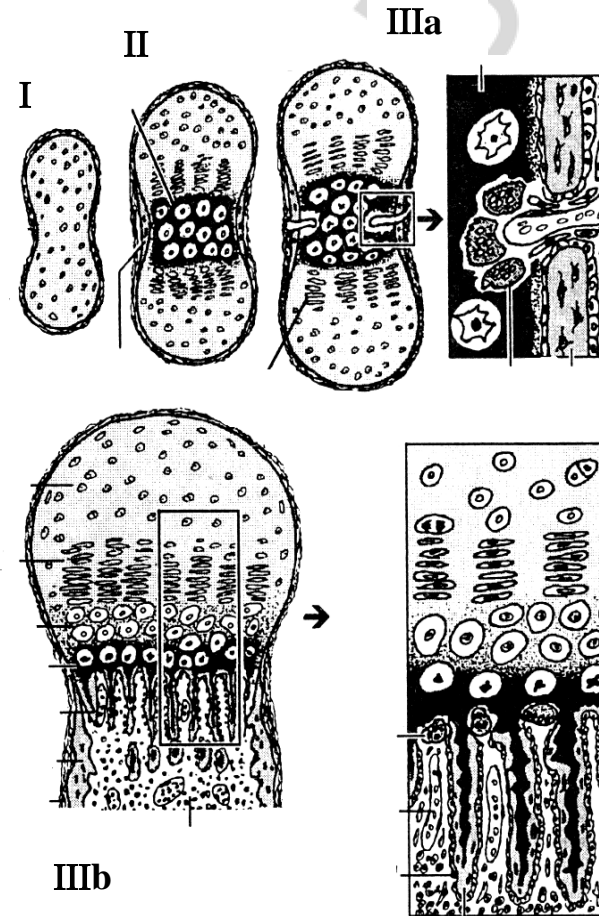
Staining: Hematoxylin-eosin
Magnification: 400×

Draw and designate:

- 1 — mesenchyme;
- 2 — osteoblasts;
- 3 — osteocytes;
- 4 — osteoclasts;
- 5 — intercellular substance of reticularfibrous bone tissue;
- 6 — blood vessels.

**Task 62. ENDOCHONDRAL OSSIFICATION (INDIRECT
OSTEOGENESIS)**

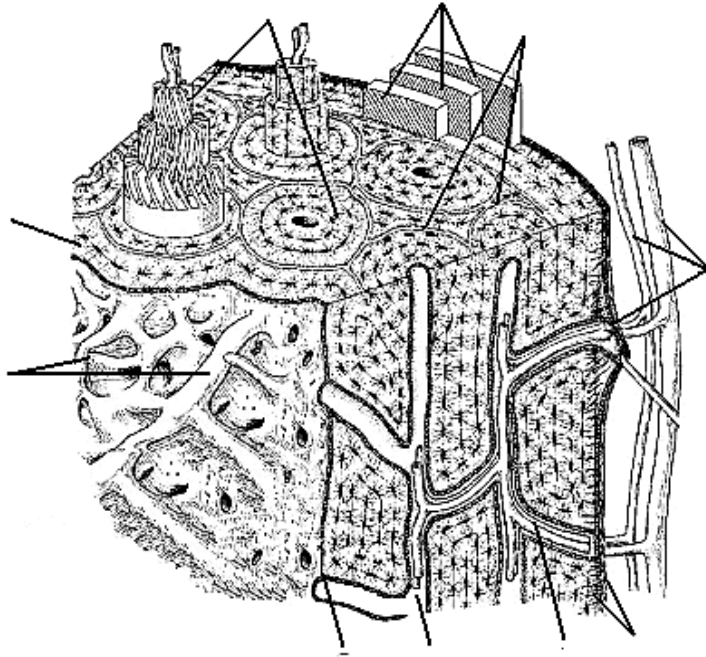
Staining: Hematoxylin-eosin
Magnification: 400×



Designate:

- I — Hyaline cartilage “model”
- II — Primary ossification center
- 1 — bony collar — perichondral bone
- III — Calcified cartilage
- a — osteogenic cells, osteoclasts, blood vessels penetrate into cartilage;
- b — forming of enchondral bone
- 2 — zone of resting cartilage;
- 3 — zone of proliferating cartilage (column cartilaginous cells);
- 4 — zone of hypertrophied cartilage;
- 5 — zone of calcified cartilage;
- 6 — zone of resorption and ossification.

Task 63. STRUCTURAL SCHEME OF COMPACT SUBSTANCE OF LONG BONE



Designate:

- 1 — periosteum with blood vessels;
- 2 — blood vessels;
- 3 — outer layer of general lamellae;
- 4 — osteons;
- 5 — osteon canals;
- 6 — trophic canal;
- 7 — system of interstitial lamellae;
- 8 — inner layer of general lamellae;
- 9 — endosteum.

Task 64. CROSS-SECTION OF COMPACT SUBSTANCE OF LONG BONE

Staining: Schmorl method
Magnification: 400×

Designate:

- 1 — osteon canal;
- 2 — osteon lamellae;
- 3 — lacuna (osteocyte bodies);
- 4 — canaliculi osseous (osteocyte processes);
- 5 — interstitial lamellae.

Correct tasks № _____

Lecturer _____

Topic 10. MUSCULAR TISSUES

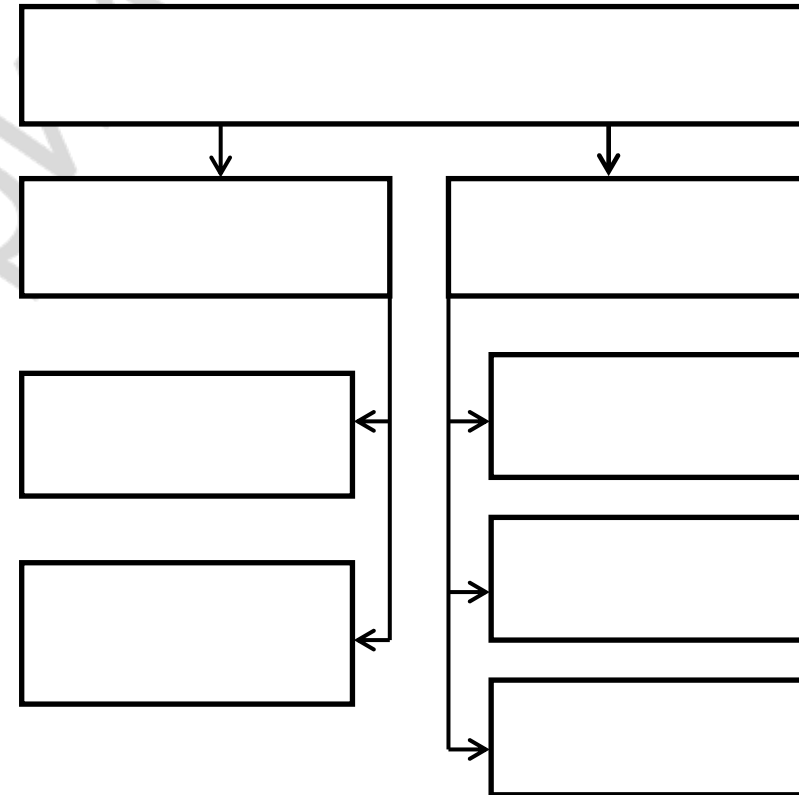
1. General characteristics of muscle tissues (classification, sources of development, location in the body, basic structural principles, functions, regeneration, peculiarities of blood supply and innervation).
2. Comparative characteristics of different types of muscle tissue structural units: morphofunctional units, peculiarities of its structure, principles of location in the tissue and types of intercellular contacts.
3. Smooth muscle tissues: structure of smooth myocytes, contraction apparatus and molecular mechanism of contraction.
4. Skeletal muscle tissue. General plan structure of the muscle fibers. Contraction apparatus of muscle fibers. Structure of sarcomere. Mechanism of muscle contraction.
5. Structure of skeletal muscle as an organ. A motor unit. Comparative characteristic of different types of skeletal muscular fibers (red, white and intermediate fibers).
6. Cardiac muscular tissue. Comparative characteristic of different types of cardiomyocytes (contractile and conductive cardiomyocytes).

Task 65.

Muscle tissues provide movement of the whole body, its parts and inner organs.

It results from constriction (shortening) of muscle cells or fibers as a result of movement of their special elements — **myofilaments** in the form of actin and myosin.

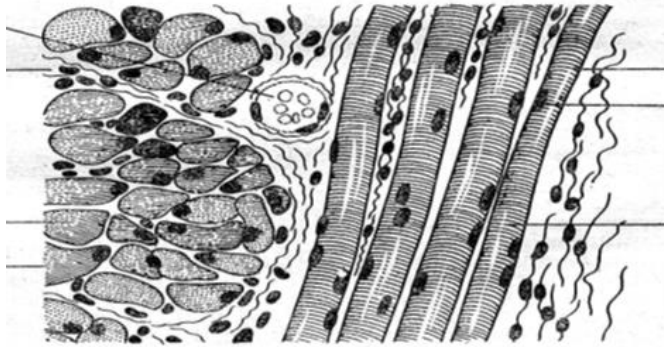
Task 66. CLASSIFICATION OF THE MUSCULAR TISSUE



Task 67. SKELETAL MUSCLE TISSUE OF THE TONGUE

Staining: Iron hematoxylin
Magnification: 400×

A

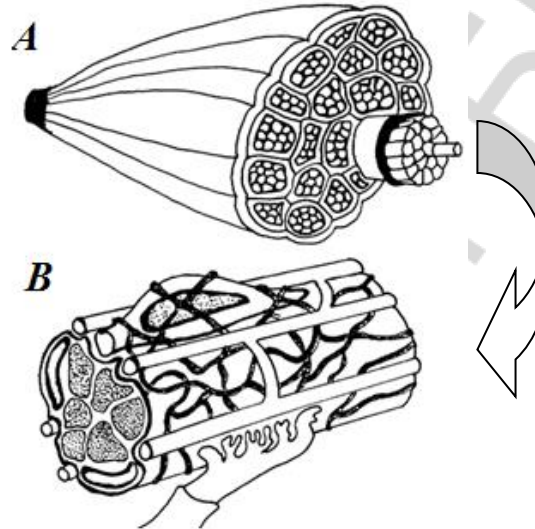


B

Designate scheme (A) and picture (B):

1 — longitudinal section of muscle fibers; 2 — transverse section of muscle fibers; 3 — sarcolemma; 4 — myosymplast nuclei; 5 — endomysium; 6 — perimysium.

Task 68. SCHEME OF MUSCLE'S STRUCTURE AS AN ORGAN



Designate:

A — structure of muscle:

1 — epimysium; 2 — perimysium;
3 — muscular fiber.

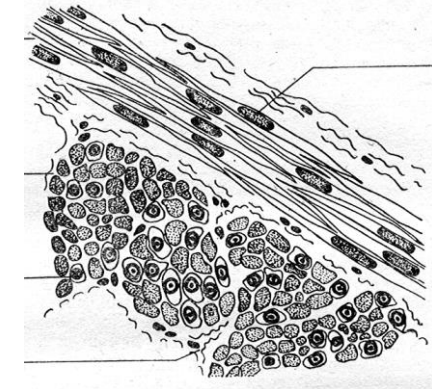
B — structure of myon:

4 — muscle fiber (myosymplast); 5 — myosatellitocyte; 6 — α -motoneuron axon and its contact with myosymplast; 7 — endomysium: 7a — capillaries; 7b — elastic and reticular fibers.

Task 69. SMOOTH MUSCULAR TISSUE OF URINARY BLADDER

Staining: Hematoxylin-eosin
Magnification: 400×

A



B

Designate scheme (A) and picture (B):

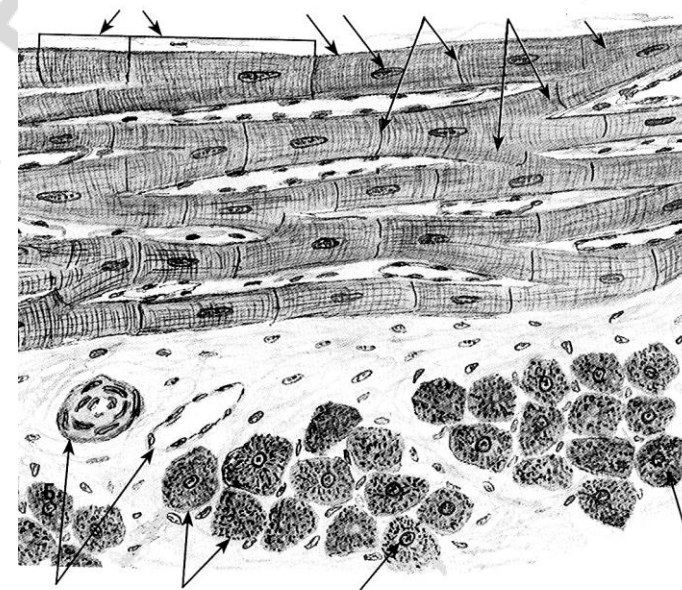
1 — muscular cells in longitudinal section;
2 — muscular cells in cross section;
3 — nuclei of muscular cells;
4 — connective tissue (perimysium).

Task 70. COMPARATIVE CHARACTERISTICS OF VARIOUS TYPES OF CARDIOMYOCYTES

| | Contractile | Conductive |
|------------------------------------|-------------|------------|
| Functions | | |
| Type of metabolism | | |
| Resistance to oxygen insufficiency | | |
| Predominant type of inclusions | | |
| Mitochondria (number and size) | | |
| Myofibrils (number and location) | | |
| Location in myocardium | | |

Task 71. CARDIAC MUSCLE TISSUE

Staining: Iron hematoxylin
Magnification: 400×

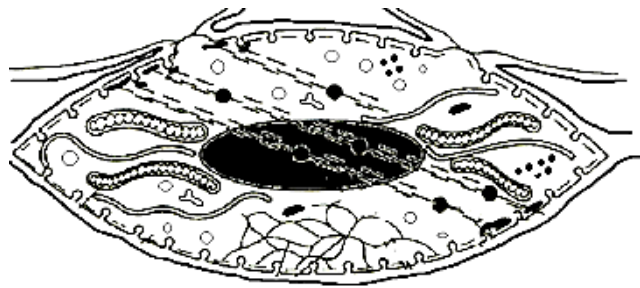
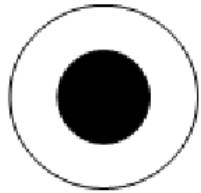


Designate:

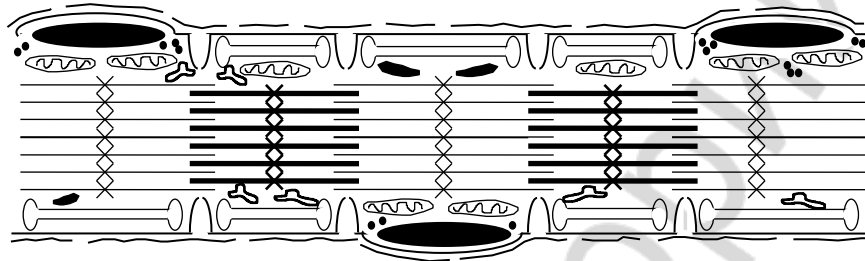
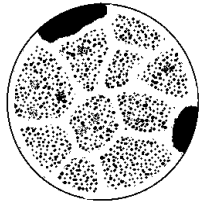
- 1 — cardiomyocyte nuclei;
- 2 — intercalated discs
- 3 — anastomosis;
- 4 — myofibrils;
- 5 — connective tissue.

Task 72. STRUCTURAL SCHEME OF MUSCULAR TISSUE ELEMENTS

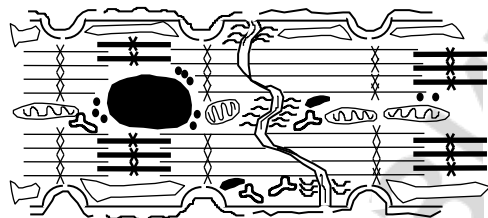
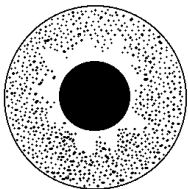
A



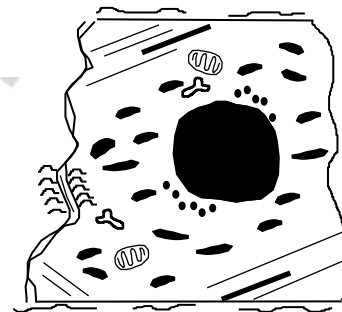
B



C



D



Designate:

A — cell of smooth muscular tissue — smooth myocyte (SMC);

B — unit of skeletal muscular tissue — myosymplast;

C — contractile cardiomyocytes;

D — conductive cardiomyocyte.

Supporting structure

1 — sarcolemma: 1a — cytolemma; 1b — basal membrane; 1c — T-tubules; 1d — caveolae;

2 — myofilaments' attachment site: 2a — dense bodies (in SMC); 2b — dense stripes (in SMC); 2c — Z-lines (in myosymplast); 2d — M-lines (in myosymplast);

Trophic apparatus

3 — nucleus; 4 — mitochondria; 5 — smooth endoplasmic reticulum (Ca^{++} reserv.); 5a — SMC vesicles; 5b — L-tubules and terminal cisterns in myosymplast; 6 — ribosomes; 7 — glycogen inclusions; 8 — myoglobin inclusions;

Contractile apparatus

9 — actin; 10 — myosin myofilaments;

Intercellular junctions

11 — nexuses; 12 — desmosomes; 13 — interdigitations;

Cross sections

14 — nuclei; 15 — myofibrillar fields.

Task 73. COMPARATIVE CHARACTERISTICS OF VARIOUS TYPES OF MUSCLE TISSUE

| | Skeletal | Cardiac | Smooth |
|--|-----------------|----------------|----------------|
| Structure and functional unit | | | |
| Nucleus(i): number and localization | | | |
| Presence of myofibrils (= striation) | | | |
| Source of development | 1. | 1. | 1. 2. 3. |
| Regeneration: – division of stem cells – intracellular regeneration | | | |
| Cell-to-cell junctions | | | |
| Sarcotubular system: – conduction of impulse inside – Ca-storage | | | |
| Type of innervation | | | |

Correct tasks № _____

Lecturer _____

Topic 11. NERVE TISSUE

1. Nerve tissue. General morphological and functional characteristics. Sources of development, histogenesis.
2. Neurons. Classification (morphological, functional, mediatorial). Morphological and functional characteristics of neurons. Transporting processes in neurocytes.
3. Neuroglia. Classification and development. Morphological and functional characteristics of different types of neuroglia.
4. Nerve fibers. Classification. Morphological and functional characteristics of myelinated and unmyelinated fibers. Process of myelinisation. Degeneration and regeneration of nerve fibers.
5. Nerve endings (receptive and efferent types), classification and structure.
6. Interneuronal synapses. General plan of synapses organization. Classification, structure, transmission of nerve impulse.

Development sources of nerve tissue is neuroectoderm

- { I –
II –
III –

Morphological and functional unit of nerve tissue: _____

Classifications of neurons:

I. Morphological

- 1.
- 2.
- 3.
- 4.

II. Functional

- 1.
- 2.
- 3.
- 4.

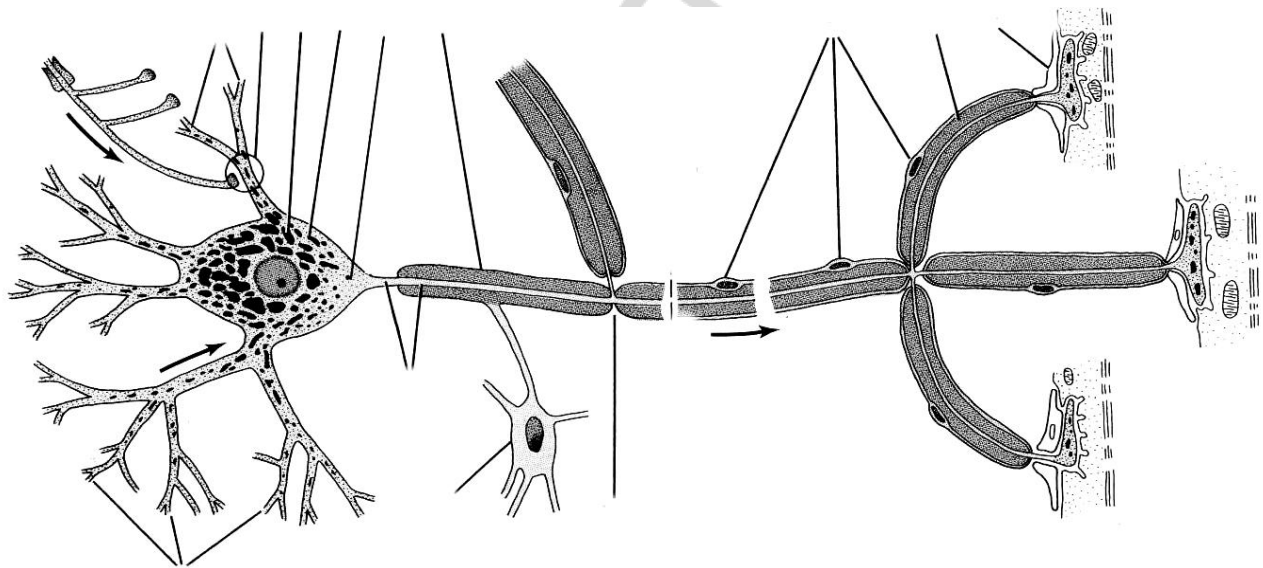
III. Mediatorial

- 1.
- 2.
- 3.
- 4.
- 5.

Task 74. STRUCTURAL SCHEME OF THE NEURON

Mark:

- 1 — nerve cell nucleus;
- 2 — axon;
- 3 — dendrites;
- 4 — cell body;
- 5 — chromatophilic substance (Nissl bodies);
- 6 — axon hillock;
- 7 — oligodendrocyte;
- 8 — recurrent axonal branch;
- 9 — axodendritic synapse;
- 10 — axial cylinder;
- 11 — myelin sheath;
- 12 — node of Ranvier;
- 13 — myelin cleft;
- 14 — lemmocyte nucleus;
- 15 — neuromuscular synapse;
- 16 — striated muscular fiber.



Task 75. CHROMATOPHILIC SUBSTANCE OF THE SPINAL CORD'S NEURONS

Staining: Toluidine blue

Magnification: 400×

Designate:

- 1 — nucleus;
- 2 — basophilic substance (Nissl bodies);
- 3 — axon;
- 4 — dendrites.

Task 76. NEUROFIBRILS OF THE SPINAL CORD'S NEURONS

Staining: Silver impregnation

Magnification: 400×

Designate:

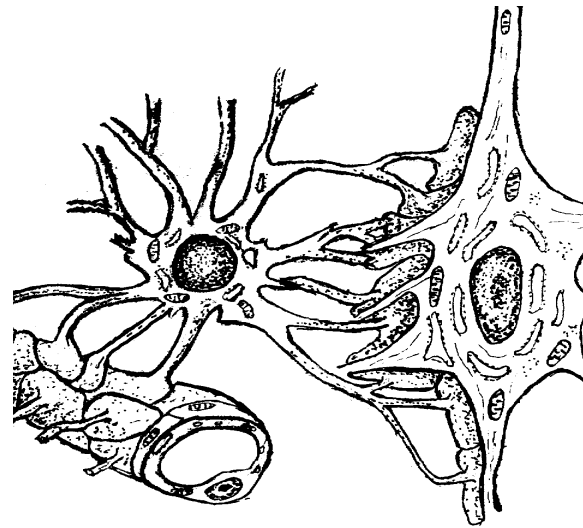
- 1 — nucleus of neuron;
- 2 — neurofibrils;
- 3 — axon;
- 4 — dendrites.

Task 77. MICROGLIA

Staining: Silver impregnation
Magnification: 400×

Draw and designate:
1 — microglial cells.

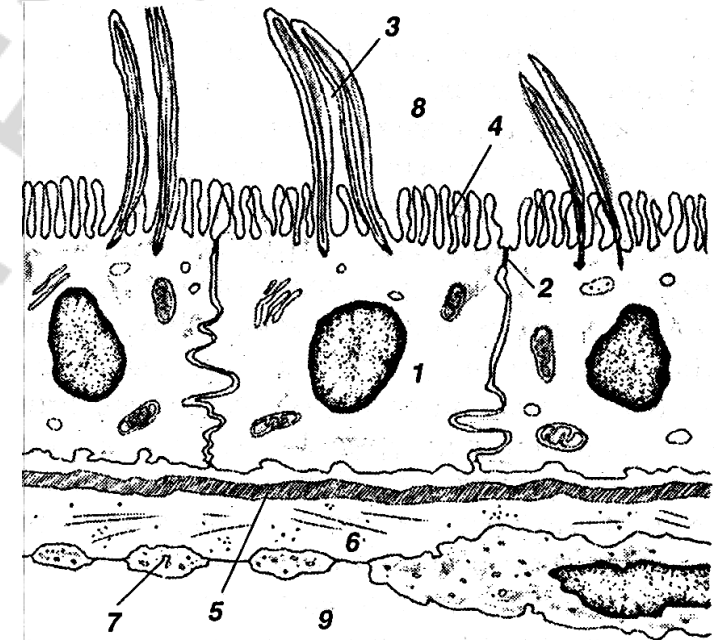
Task 78. SCHEME OF INTERACTIONS OF ASTROCYTE WITH HEMOCAPILLARY AND NEURON (BLOOD-BRAIN BARRIER)



Designate:

1 — astrocyte body; 2 — astrocyte nucleus;
3 — perivascular feet; 4 — perineural feet;
5 — hemocapillary endothelium; 6 — neuron;
7 — neuron nucleus; 8 — perikaryon; 9 — neuron processes.

Task 79. SCHEME OF HEMATO-LIQUOR BARRIER



Designate:

1 — ependymocyte; 2 — tight junction; 3 — ependymocyte cilia; 4 — ependymocyte microvilli; 5 — basal membrane; 6 — perivascular space; 7 — endothelium.

| | | | | | |
|----------|--|----------|--|----------|--|
| Origin | | Origin | | Origin | |
| Function | | Function | | Function | |

Task 80. UNMYELINATED NERVE FIBERS

Staining: Hematoxylin-eosin

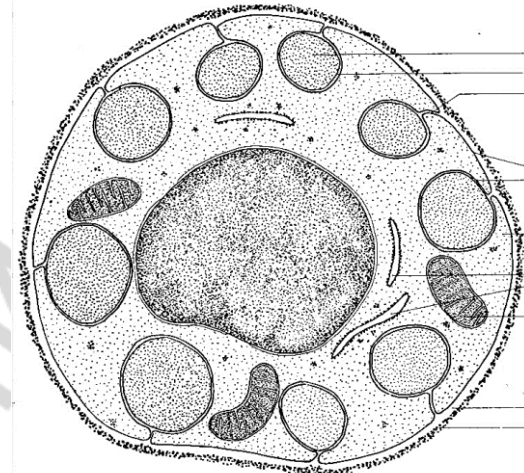
Magnification: 400×

A

Designate picture (A) and scheme (B):

1 — lemmocyte nuclei; 2 — non-myelinated nerve fibres; 3 — axial cylinders;
4 — mesaxon.

Nerve fiber is a neuron's processes covered by glial sheath.



B

Task 81. MYELINATED NERVE FIBERS

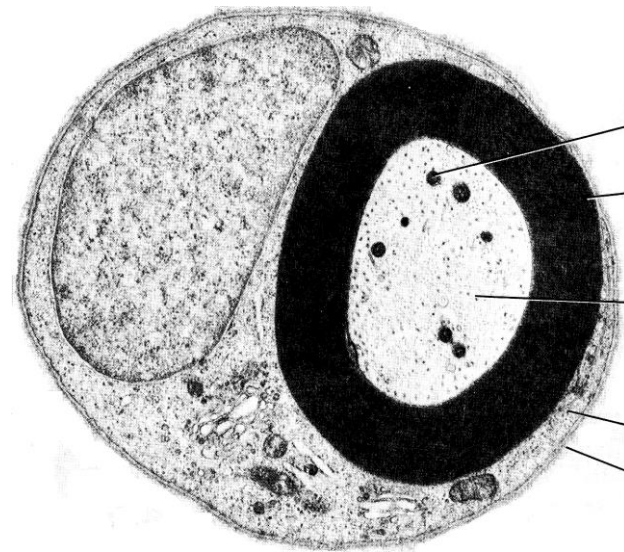
Staining: Osmic acid

Magnification: 400×

A

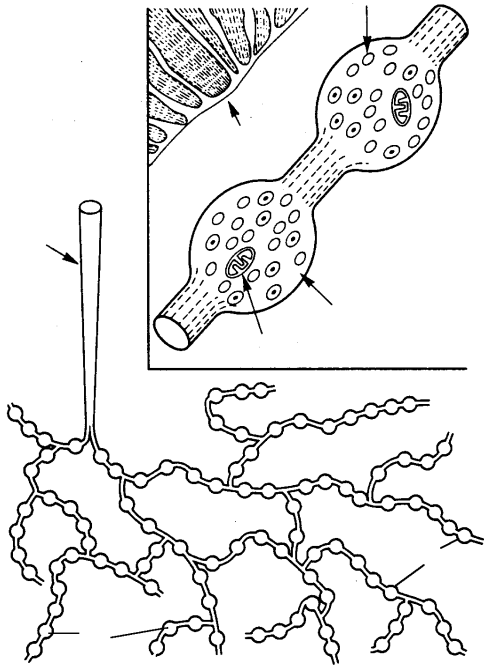
Designate picture (A) and scheme (B):

1 — axial cylinder; 2 — myelinated nerve fiber; 3 — neurilemma; 4 — lemocyte nuclei; 5 — node of Ranvier or nodal gap; 6 — myelin sheath.



B

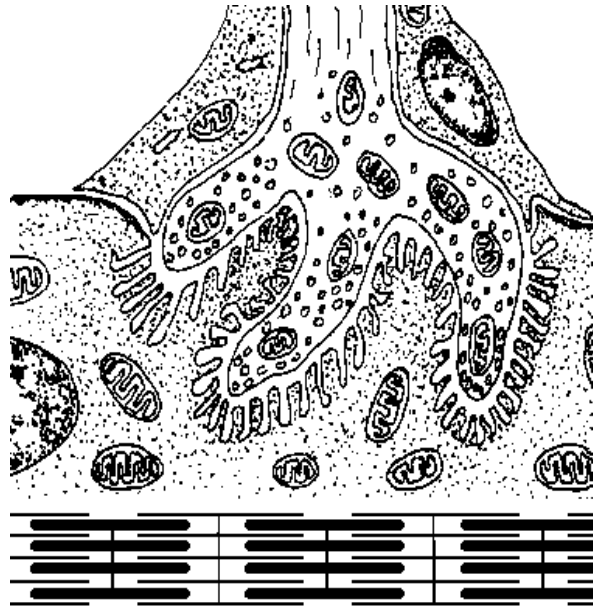
Task 82. EFFERENT ENDING OF SMOOTH MUSCLE



Designate:

- 1 — smooth cells;
- 2 — axon;
- 3 — axon terminals;
- 4 — varicose dilations;
- 5 — vesicles with mediator;
- 6 — mitochondria.

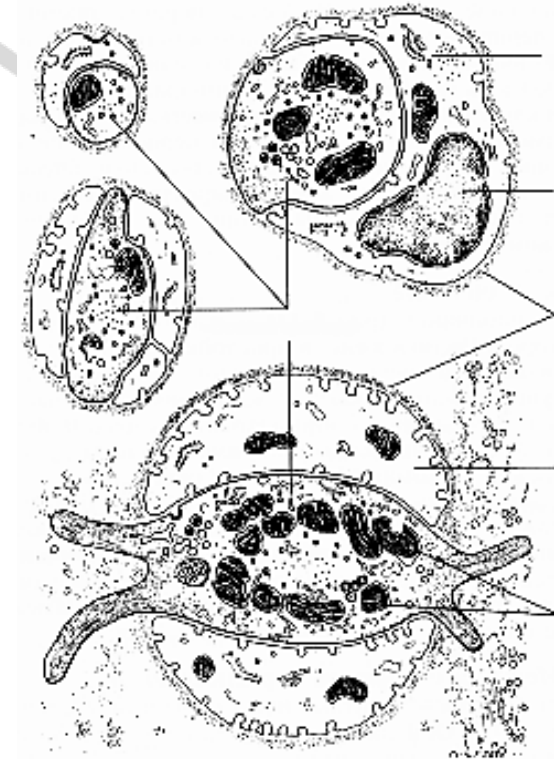
Task 83. NEUROMUSCULAR SYNAPSE



Designate:

- 1 — presynaptic membrane;
- 2 — synaptic vesicles;
- 3 — axon mitochondria;
- 4 — lemmocyte;
- 5 — postsynaptic membrane;
- 6 — myosmyplast nucleus;
- 7 — mitochondrion of muscle fiber;
- 8 — myofibrils;
- 9 — synaptic cleft.

Task 84. NONFREE NONENCAPSULATED ENDINGS



Designate:

- 1 — terminal of sensory nerve fibers;
- 2 — modified Schwann cells;
- 3 — nucleus of Schwann cell;
- 4 — basal lamina.

Correct tasks № _____

Lecturer _____

Date « » _____

Topic 12. CARDIOVASCULAR SYSTEM

1. General morphological and functional description of the cardiovascular system. Principles of vessel innervation and nourishment.
2. Classification of vessels, their development, general structure.
3. Arteries. Classification. Dependence of the artery wall structure on haemodynamic conditions.
4. Veins. Classification. Influence of haemodynamic conditions on the vein wall structure.
5. Microcirculation. The structure and functional description of its vessels. Capillaries: classification, organ specificity. Histochemical barriers. Lymphatic capillaries.
6. Anastomoses between arterioles and venules. Classification. Structure, functional description.
7. The heart. Sources and stages of development, structure of cardiac membranes. Structure of heart valves.
8. Morphofunctional and histochemical description of contractile cardiac muscle tissue. Regeneration.
9. Conductive cardiac system. Ultrastructural and histochemical description of conductive myocytes. Peculiarities of interaction between conductive cardiac system and contractile cardiomyocytes.
10. Secretory cardiomyocytes, their morphological and functional description.

The functions of the cardiovascular system:

1. _____
2. _____
3. _____
4. _____

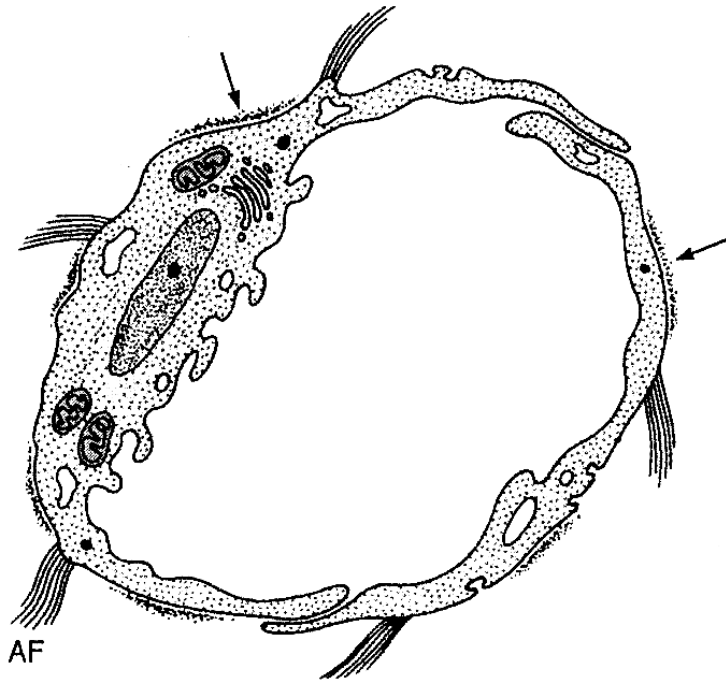
Definition of the organ _____

Classification of organs:

Stroma _____

Parenchyma _____

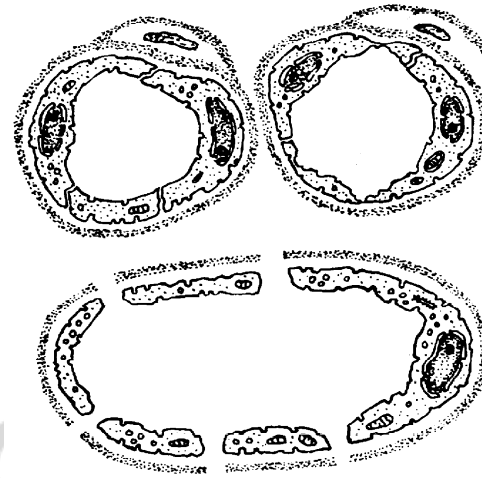
Task 85. ULTRAMICROSCOPIC STRUCTURE OF THE LYMPHATIC CAPILLARY WALL



Designate:

- 1 — endothelial cells (EC);
- 2 — EC nucleus;
- 3 — discontinuous basal membrane;
- 4 — anchoring (collagen) fibrils.

Task 86. ULTRAMICROSCOPIC STRUCTURE OF THE BLOOD-CAPILLARY WALL



Designate:

- A — somatic capillary;
- B — fenestrated capillary;
- C — sinusoidal capillary.

- 1 — endothelial cells (EC);
- 2 — EC nucleus;
- 3 — basal membrane;
- 4 — pericytes;
- 5 — EC fenestras;
- 6 — pores in the EC.

Task 87. SMALL BLOOD VESSELS OF THE SOFT BRAIN MEMBRANE



Designate:

- 1 — arteriole;
- 2 — venule;
- 3 — capillary;
- 4 — myocytes;
- 5 — endotheliocytes nuclei;
- 6 — adventitious cells;
- 7 — erythrocytes;
- 8 — connective tissue cells.

Task 88. MUSCULAR ARTERY

Staining: Hematoxylin-eosin

Magnification: 400×

Draw and to designate:

I — Tunica intima:

- 1 — endothelium;
- 2 — subendothelial layer;
- 3 — internal elastic membrane.

II — Tunica media:

- 4 — smooth muscle cells;
- 5 — intracellular substance;
- 6 — external elastic membrane.

III — Tunica externa (adventitia):

- 7 — intracellular substance;
- 8 — connective tissue cell nuclei;
- 9 — vascular vessels.

Task 89. ELASTIC ARTERY (aorta)

Staining: Orsein

Magnification: 400×

*Draw the preparation and designate
the elastic fibres and elastic fenestrated
lamellae:*

- 1 — tunica intima;
- 2 — tunica media;
- 3 — tunica externa.

Task 90. VEIN(femoral vein)

Staining: Hematoxylin-eosin

Magnification: 400×

Draw and designate:

I — Tunica intima:

- 1 — endothelium;
- 2 — subendothelial layer.

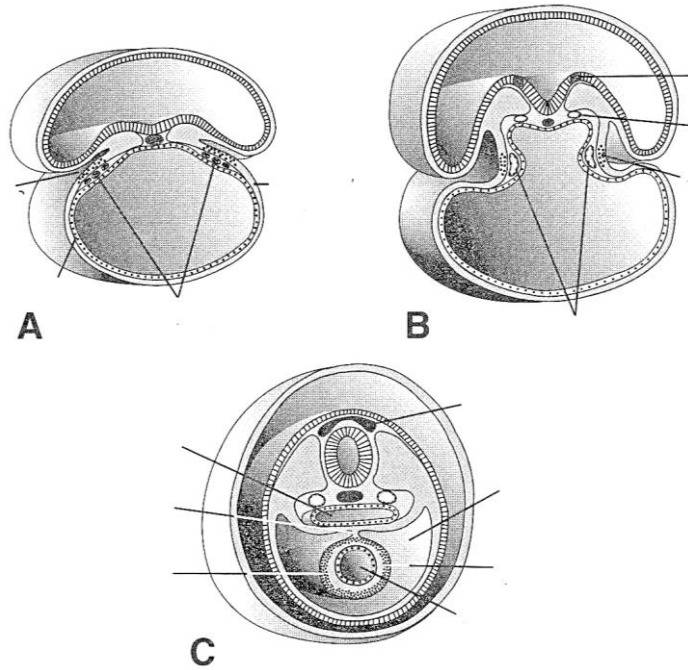
II — Tunica media:

- 3 — muscular cells with circular orientation;
- 4 — intracellular substance with elastic fibers;

III — Tunica externa:

- 5 — intracellular substance;
- 6 — connective tissue cell nuclei;
- 7 — longitudinal bundles of smooth muscle cells;
- 8 — vascular vessels.

Task 91. SCHEME OF HEART DEVELOPMENT



Designate:

A — paired primordia of the heart; B — paired primordia of the heart are converged; C — paired primordia unite and form endothelial tube.

1 — ectoderm; 2 — endoderm; 3 — parietal mesodermal layer;
 4 — visceral mesodermal layer; 5 — neural groove; 6 — neural tube; 7 — neural crest; 8 — coelom; 9 — foregut; 10 — angioblast and endocardial tube; 11 — myoepicardial plate;
 12 — myocardium; 13 — epicardium; 14 — pericardial cavity.

Task 92. THE CARDIAC WALL

Staining: Haematoxylin-eosin
 Magnification: 400×



Draw and designate:

I — Endocardium:

- 1 — endothelial layer;
- 2 — subendothelial layer;
- 3 — myoelastic layer;
- 4 — subendocardial layer.

II — Myocardium:

- 5 — typical cardiomyocytes;
- 6 — intercalated disc;
- 7 — connective tissue with capillaries;
- 8 — conducting cardiomyocytes (Purkinje fibers);
- 9 — anastomoses between cardiomyocytes.

III — Epicardium:

- 10 — lamina propria with adipose cells;
- 11 — mesothelial cells.

Correct tasks № _____

Lecturer _____

Topic 13. RESPIRATORY SYSTEM

1. Respiratory system. Morphological and functional characteristics. Respiratory and non-respiratory functions.
2. Structure and functions of the trachea.
3. Structure of bronchi of various sizes.
4. Lungs. Structure of respiratory divisions. Cellular structure of alveolar wall.
5. Surfactant system of the lungs.
6. Aero-hematic barrier.

Fill in the table at home.

| Air passage | Respiratory part |
|-------------|------------------|
| 1. | 1. |
| 2. | 2. |
| 3. | 3. |
| 4. | 4. |
| 5. | |
| a) | |
| b) | |
| c) | |
| 6. | |

Task 93. NASAL MUCOSA (RESPIRATORY AREA)

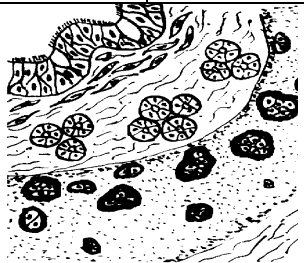

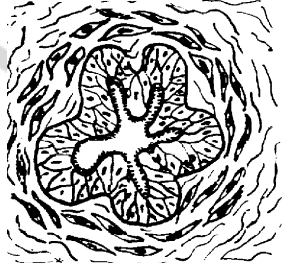
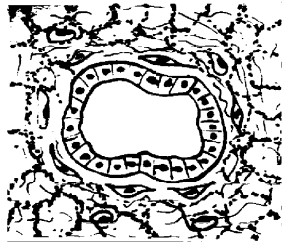
Staining: Hematoxylin-eosin
Magnification: 400×



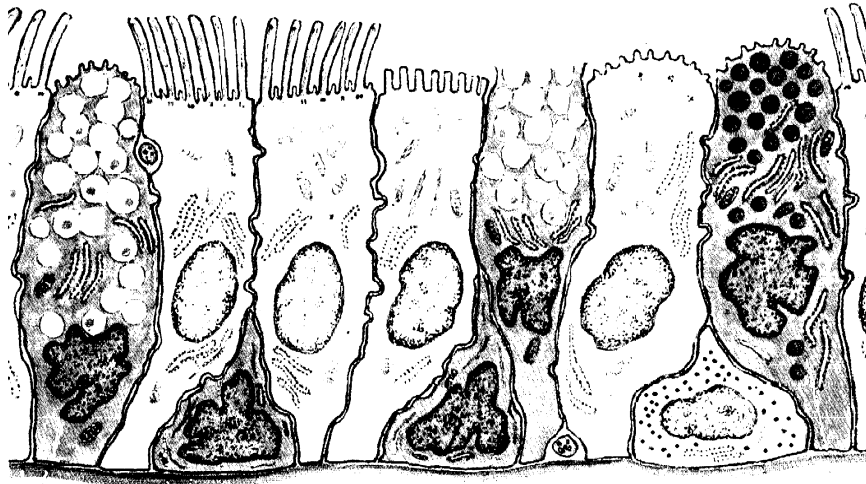
Designate:

- 1 — stratified ciliated epithelium; 2 — goblet cells;
3 — excretory ducts of protein-mucous glands;
4 — terminal portions of the glands; 5 — lamina propria of the mucous membrane; 6 — arteries; 7 — veins;
8 — venous sinuses.

Task 94. STRUCTURE OF DIFFERENT PARTS OF AIR PASSAGE

| Membrane | Trachea | Principal bronchi (large) | Lobar (medium) bronchi | Small bronchi | Terminal bronchiole |
|-------------------------------------|---|---------------------------|---|---|---|
| I. The mucous membrane: |  | |  |  |  |
| 1) Epithelium | 1. | | | | |
| | a) | | | | |
| | b) | | | | |
| | c) | | | | |
| | d) | | | | |
| | e) | | | | |
| 2) Lamina propria | | | | | |
| 3) Muscularis layer | | | | | |
| Folds of mucosa | | | | | |
| II. Submucous membrane | | | | | |
| III. Fibrous-cartilaginous membrane | | | | | |
| IV. Adventitial membrane | | | | | |

Task 95. EPITHELIAL CELLS OF AIR PASSAGE



Designate:

- 1 — goblet cell;
- 2 — ciliated cells;
- 3 — basal cell;
- 4 — brush cell;
- 5 — goblet cell;
- 6 — aciliated cell;
- 7 — endocrine cell;
- 8 — secretory cell (Clara's cell in the bronchiolae).

Task 96. TRACHEA

Staining: Hematoxylin-eosin

Magnification: 400×

Draw and designate:

I. Mucous membrane:

1 — pseudostratified ciliated epithelium;

2 — lamina propria;

II. Submucous membrane:

3 — secretory portions of serous-mucous glands;

III. Fibrous-cartilaginous membrane:

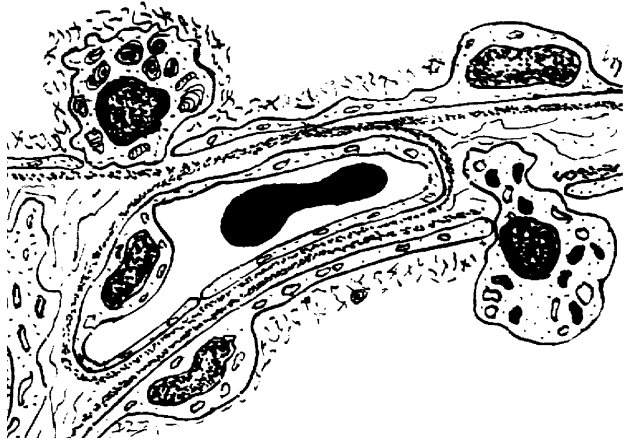
4 — perichondrium

5 — hyaline cartilage;

IV. Adventitial membrane:

6 — blood vessels.

Task 97. STRUCTURE OF ALVEOLAR WALL



Designate:

- 1 — type I alveolar epithelial cell;
- 2 — type II alveolar epithelial cell;
- 3 — alveolar macrophage;
- 4 — common basement membrane of capillary endothelium and alveolar epithelium;
- 5 — capillary endothelium;
- 6 — surfactant.

Correct tasks № _____

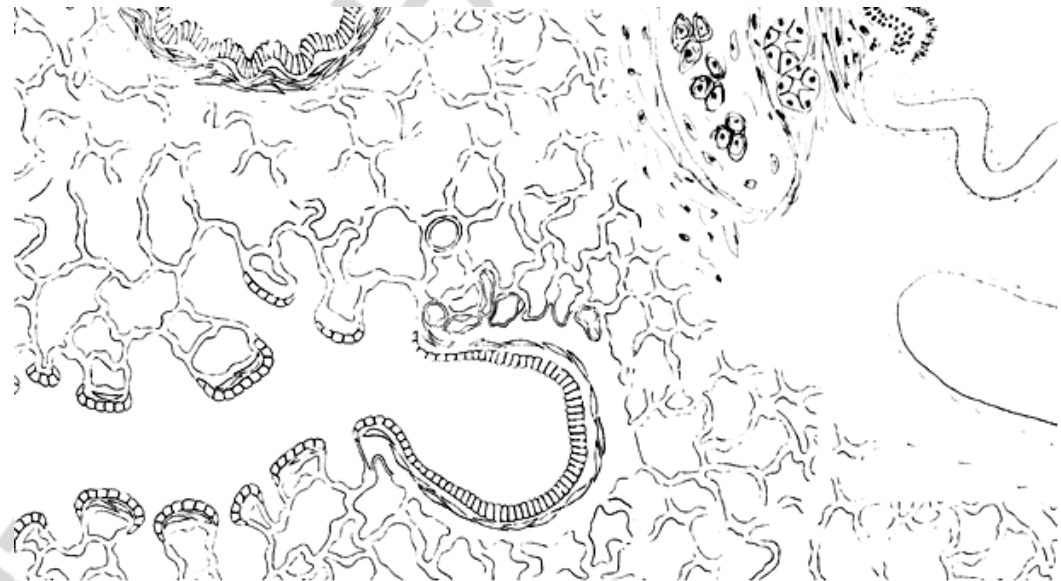
Lecturer _____

Date « ____ » _____

Task 98. THE LUNG

Staining: Hematoxylin-eosin

Magnification: 400×



Draw and designate:

- A** — medium bronchus; **B** — small bronchus; **C** — terminal bronchioles;
- D** — respiratory bronchioles

1 — pseudostratified ciliated epithelium of the mucous membrane; 2 — lamina propria of the mucous membrane; 3 — lamina muscularis of the mucous; 4 — submucous membrane; 5 — glands of the medium bronchi; 6 — cartilage of fibrous-cartilaginous membrane; 7 — adventitial membrane; 8 — alveolar lumen; 9 — interalveolar septum; 10 — blood vessels.

Topic 14. INTEGUMENTARY SYSTEM (SKIN)

1. Integumentary system (the skin). Morphological and functional characteristics. Sources of development.
2. Skin. Morphological and functional characteristics of thick skin epidermis (that of the palms and feet). Keratinization and regeneration of skin epidermis.
3. Morphological and functional characteristics of skin epidermis melanocytes and dendrocytes and their development.
4. Structure and function of the connective tissue basis of the skin (dermis). Organization peculiarities of papillary and reticular tissue layers. Skin receptors.
5. Skin glands. Morphological and functional characteristics of eccrine and apocrine sweat glands. Topographic, structural and secretory peculiarities of sebaceous glands.
6. Development and structure of hair. Hair types. Hair growth and replacement. Nail structure.
7. Age- and sex-related peculiarities of the skin.

Skin is the largest organ of the body — 1.5–2 m².

Task 99. ORIGIN AND FUNCTIONS OF EPIDERMIS CELLS
(fill in the table)

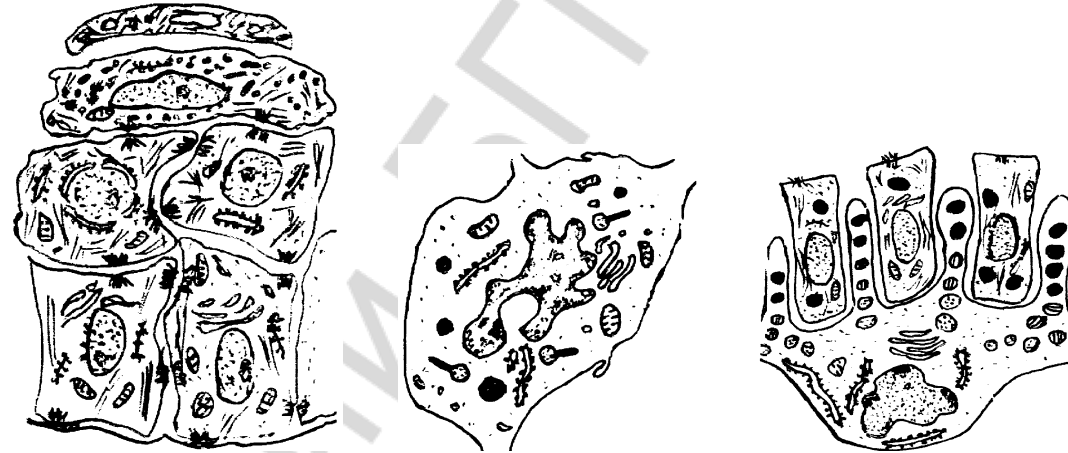
| Type of epidermis cell | Source of development | Function |
|------------------------|-----------------------|--|
| Keratinocyte | | I. II. Synthesis of proteins: 1. 2. 3. |
| Melanocyte | | |
| Merkel's cell | | |
| Langerhan's cell | | |
| Lymphocyte | | |

Task 100. FINGER'S SKIN

Staining: Hematoxylin-eosin

Magnification: 400^x

Task 101. TYPES OF SKIN EPIDERMIS CELLS



Designate:

I — keratinocytes: 1 — basal cell; 2 — spinous cell; 3 — granular cell; 4 — corneocyte.

II — melanocyte: 5 — melanosomes of melanocytes;

III — dendrocytes (Langerhan's cell): 6 — tennis racquet-shaped granules.

Draw and designate:

I — epidermis:

1 — stratum basale;

2 — stratum spinosum; 7 — reticular layer;

3 — stratum granulosum;

4 — stratum lucidum;

5 — stratum corneum.

II — dermis:

6 — papillary layer;

7 — reticular layer;

8 — sweat glands;

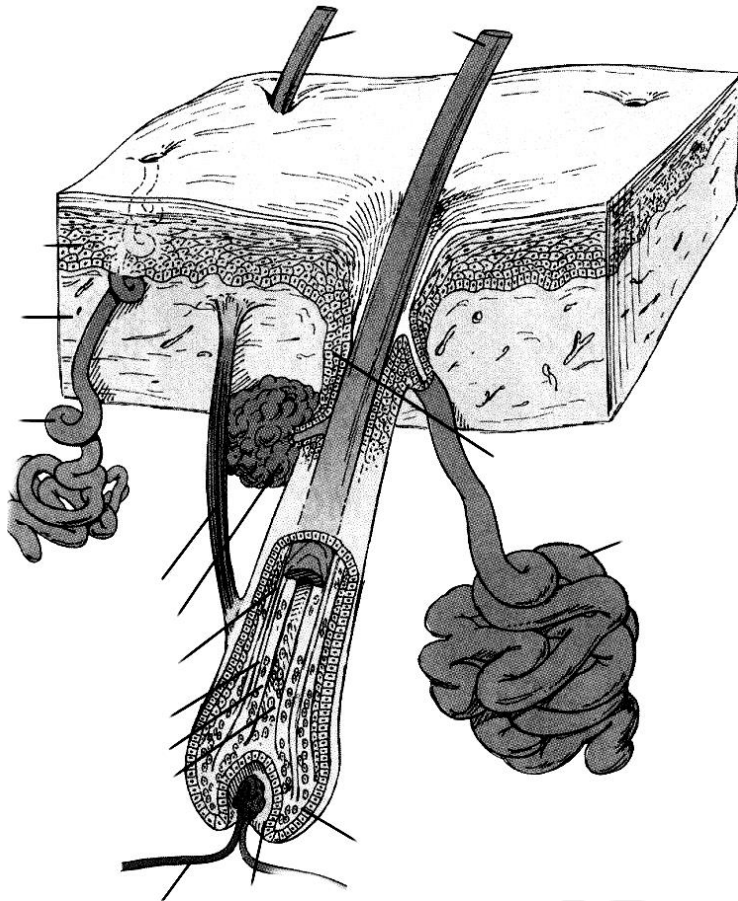
9 — blood vessels.

III — hypodermis.

Task 102. SKIN GLANDS

| Types of glands | Structural type | Type of secretion | Location in skin |
|---|-----------------|-------------------|------------------|
| 1. Sweat glands: a) merocrine b) apocrine | | | |
| 2. Sebaceous | | | |
| 3. Mammary | | | |

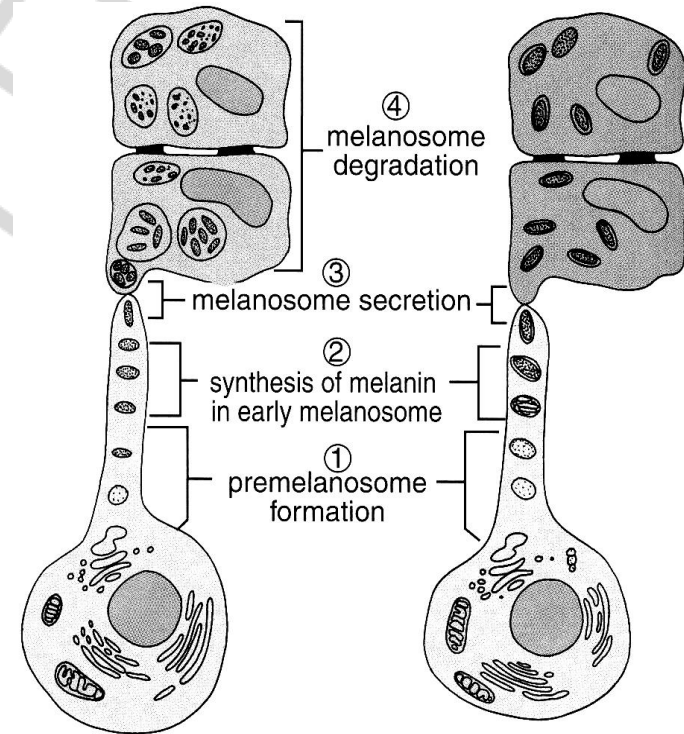
Task 103. SKIN AND ITS APPENDAGES (SCHEME)



Designate:

- 1 — epidermis;
- 2 — dermis;
- 3 — cortex of the hair;
- 4 — medulla of the hair;
- 5 — hair cuticle;
- 6 — internal root sheath;
- 7 — external root sheath;
- 8 — connective tissue sheath;
- 9 — hair bulb;
- 10 — hair papillae;
- 11 — sebaceous gland;
- 12 — arrector pili muscle;
- 13 — eccrine sweat gland;
- 14 — apocrine sweat gland,
- 15 — blood vessels.

Task 104. FORMATION OF MELANIN PIGMENT AND SECRETION IT INTO KERATONOCYTES



Designate:

- 1 — keratinocytes; 2 — melanocytes

Correct tasks № _____

Lecturer _____

Topic 15. DIGESTIVE SYSTEM: ORGANS OF THE ORAL CAVITY, OESOPHAGUS

1. Digestive system: development sources and their derivatives, general structure (membranes and layers), functions.
2. Oral cavity, structural organization of its mucous membrane and function.
3. The lips, gums, cheeks, hard and soft palate. Their histological and physiological features.
4. Structure of the tongue. Characteristics of tongue papillae. Taste buds.
5. Teeth. Sources and basic stages of development. Microscopic structure of dentine, enamel, cementum and pulp. Tooth supporting structures.
6. Age-related changes of the oral mucous membrane.
7. Oesophagus. Sources and features of development. Oesophageal membrane structure and their topographic features. Functions of the oesophagus.

Name the main development stages of teeth:

1 _____

2 _____

3 _____

Organs of the oral cavity:

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

The structural peculiarities of the oral cavity mucosa:

Epithelium:

- is stratified squamous keratinized (gingiva, hard palate) or nonkeratinized (soft palate, lips, cheeks, floor of the mouth);
- has a large thickness (200–600 μm);
- has a high capability of regeneration.

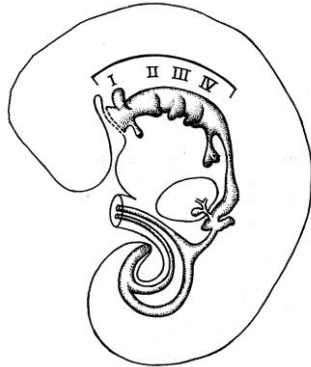
Lamina propria of the mucosa:

- forms papillae, bulging in epithelium;
- contain glands and lymphatic tissue.

The muscularis mucosa:

- is often absent.

Task 105. DEVELOPMENT SOURCES OF DIGESTIVE SYSTEM



Color:

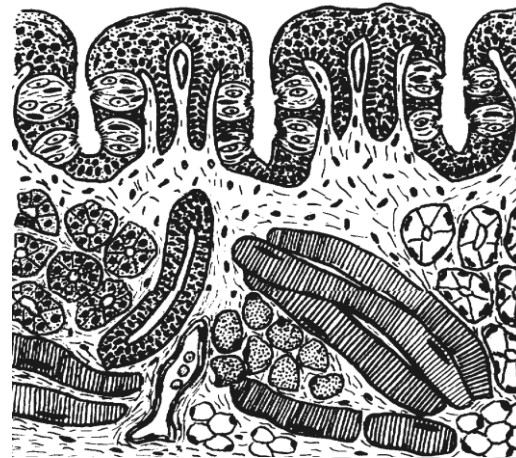
Foregut — in blue;
Midgut — in yellow;
hindgut — in red

Designate:

- 1 — stomadeum;
- 2 — oropharyngeal membrane;
- 3 — cloacal membrane;
- 4 — pharyngeal pouches;
- 5 — thyroid gland rudiment;
- 6 — oesophageal rudiment;
- 7 — respiratory system rudiment;
- 8 — stomach rudiment;
- 9 — hepatic diverticulum;
- 10 — pancreatic rudiment;
- 11 — yolk sac;
- 12 — allantois.

Task 106. TONGUE OF A RABBIT. FOLIATE PAPILLAE

Staining: Hematoxylin-eosin
Magnification: 80×, 400×



Designate and color after studying the preparation:

I — Mucous membrane:

- 1 — stratified nonkeratinized squamous epithelium;
- 2 — taste buds in epithelium;
- 3 — lamina propria of the mucous membrane;
- 4 — primary connective-tissue papillae;
- 5 — secondary connective-tissue papillae;

II — Muscular coat (muscular body):

- 6 — striated muscles of the tongue;
- 7 — secretory portions of the glands;
- 8 — excretory duct of salivary gland;
- 9 — adipose cells;
- 10 — blood vessels.

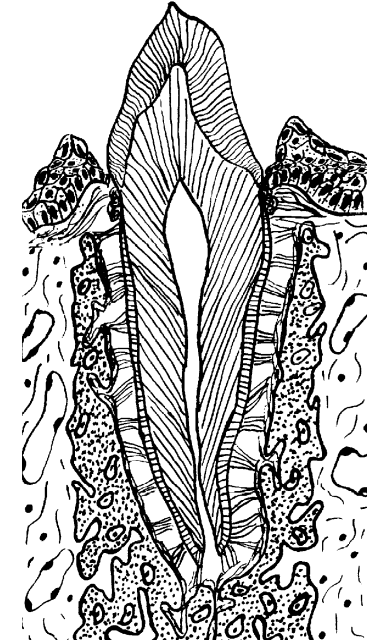
Task 107. TOOTH STRUCTURE AND TISSULAR COMPOSITION

Designate and complete:

- 1 — crown, consisting of:
 - a)
 - b)
 - c)
- 2 — neck of the tooth;
- 3 — root, consisting of:
 - a)
 - b)
 - c)

Dental ligaments (periodontal membrane), consisting of:

- 4 — gum (gingival);
- 5 — alveolar bone;
- 6 — periodontium;
- 7 — cementum.



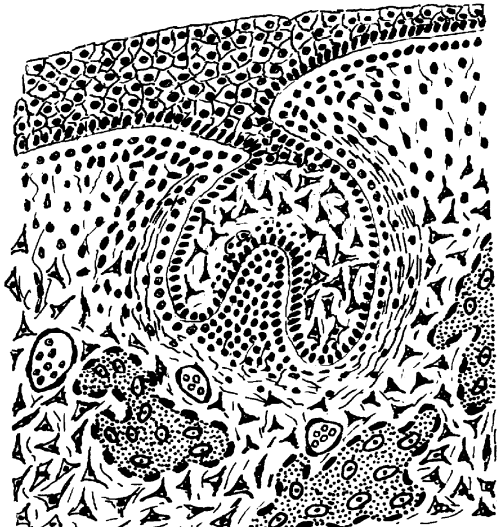
Color the tissues of the tooth in the scheme:

epithelial tissue — in green, osseous tissue — in blue, fibrous connective tissue — in yellow.

| | tissue | regeneration degree |
|--------------|--------|---------------------|
| enamel | | |
| dentin | | |
| cementum | | |
| pulp | | |
| periodontium | | |

Task 108. TOOTH DEVELOPMENT. EARLY STAGE

Staining: Hematoxylin-eosin
Magnification: 80×, 400×

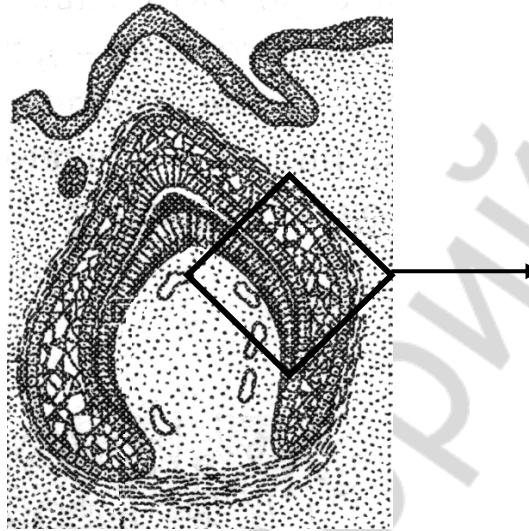


Designate:

- 1 — oral epithelium;
- 2 — mesenchyme;
- 3 — blood vessels;
- 4 — dental lamina;
- 5 — outer enamel epithelium;
- 6 — inner enamel epithelium;
- 7 — pulp of enamel organ;
- 8 — dental papilla;
- 9 — dental sac;
- 10 — dental alveolar rudiment.

Task 109. TOOTH DEVELOPMENT. LATE STAGE

Staining: Hematoxylin-eosin
Magnification: 80×, 400×



Designate:

- 1 — external enamel epithelium;
- 2 — ameloblasts;
- 3 — enamel;
- 4 — odontoblasts;
- 5 — predentine;
- 6 — dentine;
- 7 — dentinal tubules;
- 8 — pulp;
- 9 — blood vessels.

Complete the table and write down dental tissues developing:

| | |
|--|----------|
| 1. From enamel organ: – from inner layer: | |
| – from outer layer and pulp: | |
| 2. From dental papilla.: | 1. 2. |
| 3. From dental sac: | 1. 2. |

Task 110. CROSS-SECTION OF THE ESOPHAGUS

Staining: Hematoxylin-eosin

Magnification: 400×

Draw and designate:

I — mucous membrane:

1 — stratified nonkeratinized squamous epithelium;

2 — excretory ducts of proper glands;

3 — lamina propria; 4 — lamina muscularis;

II — submucous membrane:

5 — proper glands;

III — muscular membrane:

6 — a) circular; b) longitudinal layers;

7 — intramuscular nerve ganglion;

IV — adventitial membrane:

8 — connective tissue; 9 — blood vessels.

Designate:

I — mucous membrane:

1 — epithelium; 2 — lamina propria;

3 — lymphatic follicle in lamina propria;

4 — muscular lamina; 5 — crypts;

6 — villi; 7 — folds.

II — submucous membrane:

8 — complex glands.

III — muscular membrane:

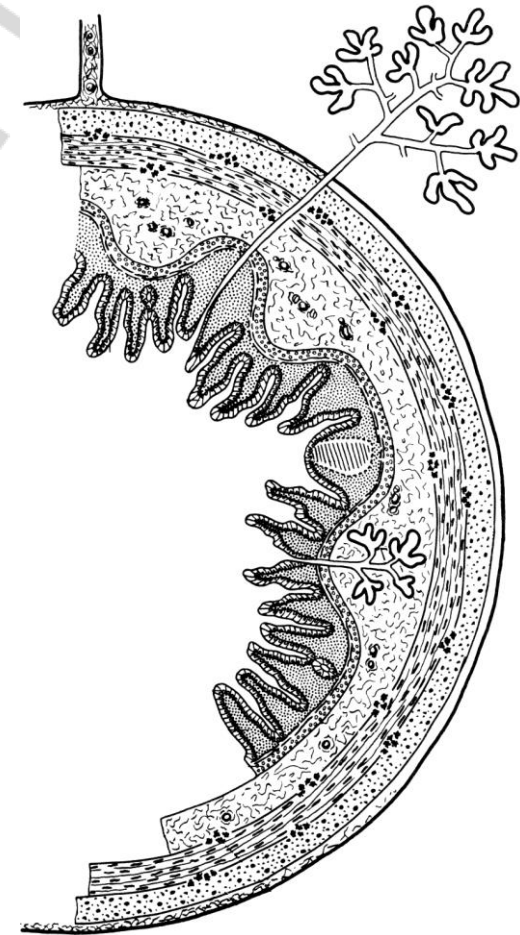
9 — inner circular layer;

10 — outer longitudinal layer;

IV — external membrane:

11 — extramural glands.

Task 111. DIGESTIVE TUBE (scheme)



Correct tasks № _____

Lecturer _____

Topic 16. DIGESTIVE SYSTEM (STOMACH, INTESTINES)

Stomach: course of development, general characteristics of its membranes, functions.

Morphological characteristics of different gastric parts: relief of gastric mucosa, glands (branching, character of secretion, cellular structure), peculiarities of muscular membrane.

Main gastric glands: topography, characteristics of excretory duct and secretory portion (degree of branching, form), cellular structure (cell localization, micro- and ultramicroscopic structure, functions).

Structural peculiarities of the gastric wall and its glands in the cardiac and pyloric regions.

Structure and functions of the small and large intestines.

Microscopic structure of small intestine villi, their functions. Ultramicroscopic structure and regeneration of the small intestine epithelium.

Cavernous, membranous and intracellular digestion. Histophysiology of the “crypt – villus” system.

Structural peculiarities of the duodenal wall.

Morphology of the large intestine wall.

Structural peculiarities of the appendix.

Endocrine system of digestive tract.

Definition of the term “Digestion” _____

Write down the organs of the digestive tract:

I. Organs of alimentary canal

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

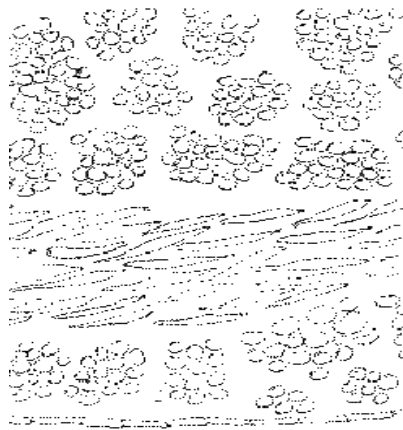
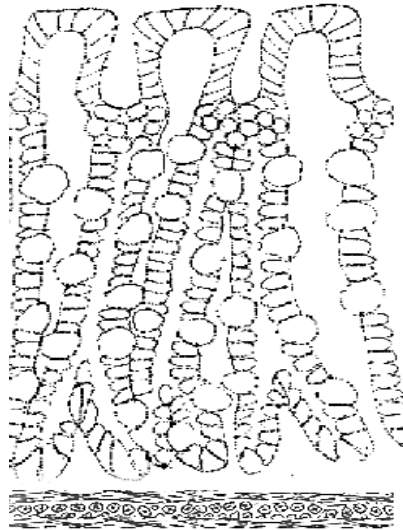
II. Digestive glands

1.
 - a)
 - b)
 - c)
- 2.
- 3.

Task 112. FUNDUS OF THE STOMACH

Staining: Hematoxylin and congo-red

Magnification: 400×



Draw and designate:

I — Mucous membrane:

- 1 — gastric pits;
- 2 — surface columnar epithelium;
- 3 — parietal cells;
- 4 — chief cells;
- 5 — neck mucous cells;
- 6 — lamina propria;
- 7 — lamina muscularis.

II — Submucous membrane:

- 8 — blood vessels

III — Muscular membrane:

- 9 — oblique (a), circular (b) and longitudinal (c) layers;
- intramuscular nerve ganglion.

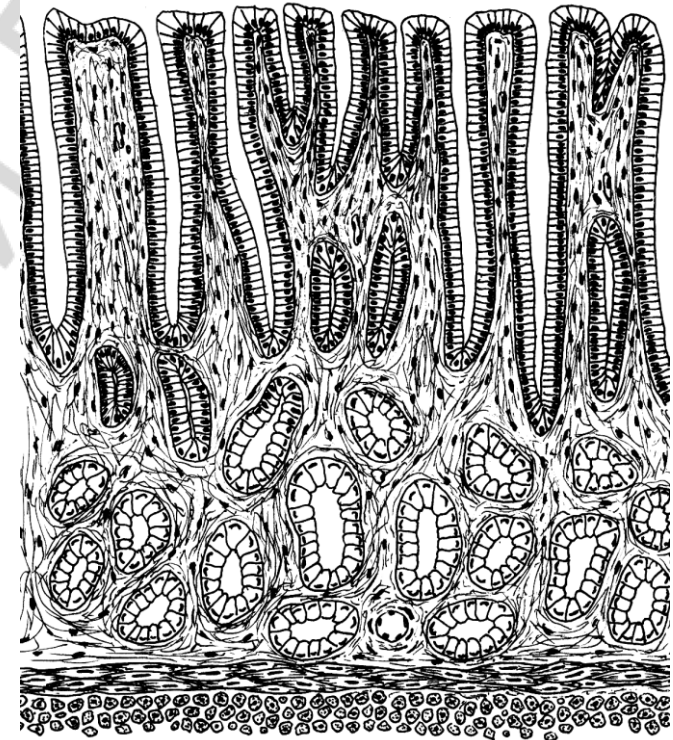
IV — Serous membrane:

- 10 — connective tissue lamina;
- 11 — nuclei of mesothelial cell.

Task 113. PYLORIC PORTION OF THE STOMACH

Staining: Hematoxylin-eosin

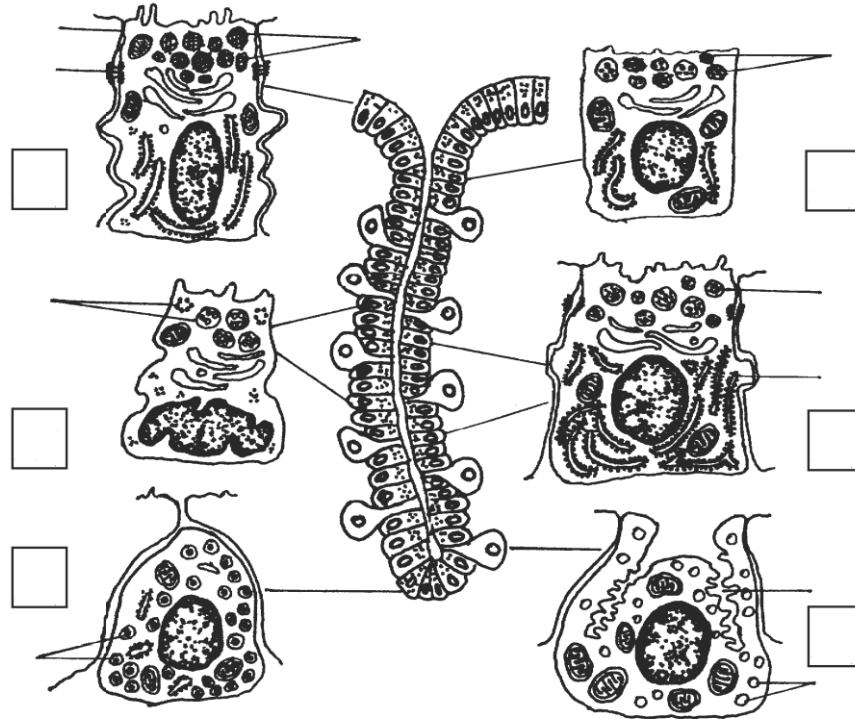
Magnification: 400×



Designate the structures of mucous membrane:

- 1 — surface mucous epithelium;
- 2 — longitudinal section of gastric pits;
- 3 — cross-section of gastric pits;
- 4 — terminal parts of pyloric glands.

Task 114. SURFACE EPITHELIUM AND CELLS OF MAIN GASTRIC GLANDS (based on electron microscopic image)



Designate:

I — surface mucous columnar epithelium:

- 1 — granules of mucous secretion;
- 2 — tight junction;

II — mucous neck cells (undifferentiated cells):

- 3 — secretory granules of different types;

III — chief cells:

- 4 — protein secretion granules;
- 5 — granular endoplasmic reticulum;

IV — mucous cells of the gland body:

- 6 — mucous secretion granules;

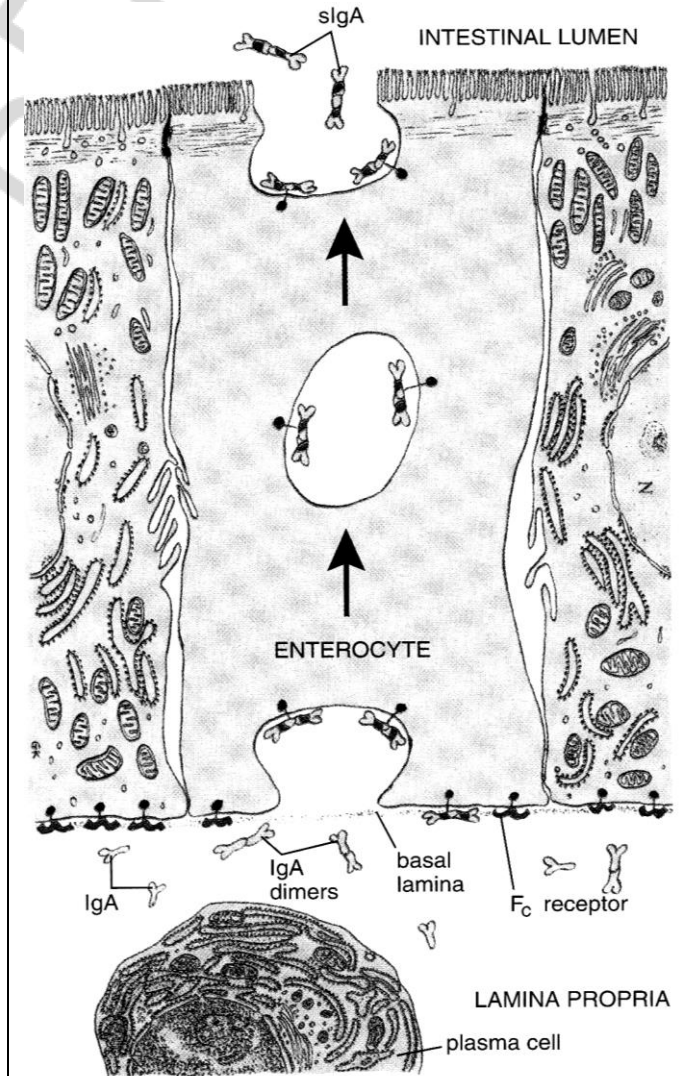
V — parietal cells:

- 7 — intracellular secretory tubule;
- 8 — vacuoles;

VI — endocrine cells:

- 9 — secretion granules.

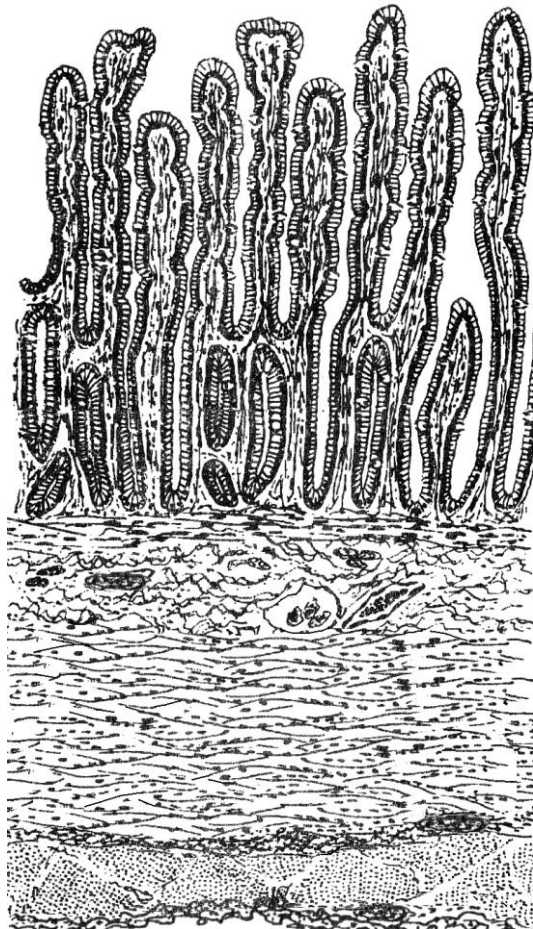
Task 115. DIAGRAM OF IgA SECRETION AND TRANSPORT



Task 116. JEJUNUM (transverse section)

Staining: Hematoxylin-eosin

Magnification: 80×, 400×



Designate and color after studying the preparation:

I — mucous membrane:

- 1 — villi;
- 2 — crypts;
- 3 — absorptive cells;
- 4 — goblet cells;
- 5 — lamina propria of the mucous membrane;
- 6 — lamina muscularis of the mucous membrane;

II — submucous membrane:

- 7 — nerve plexus node (Meisner's node);
- 8 — blood vessels;

III — muscular membrane:

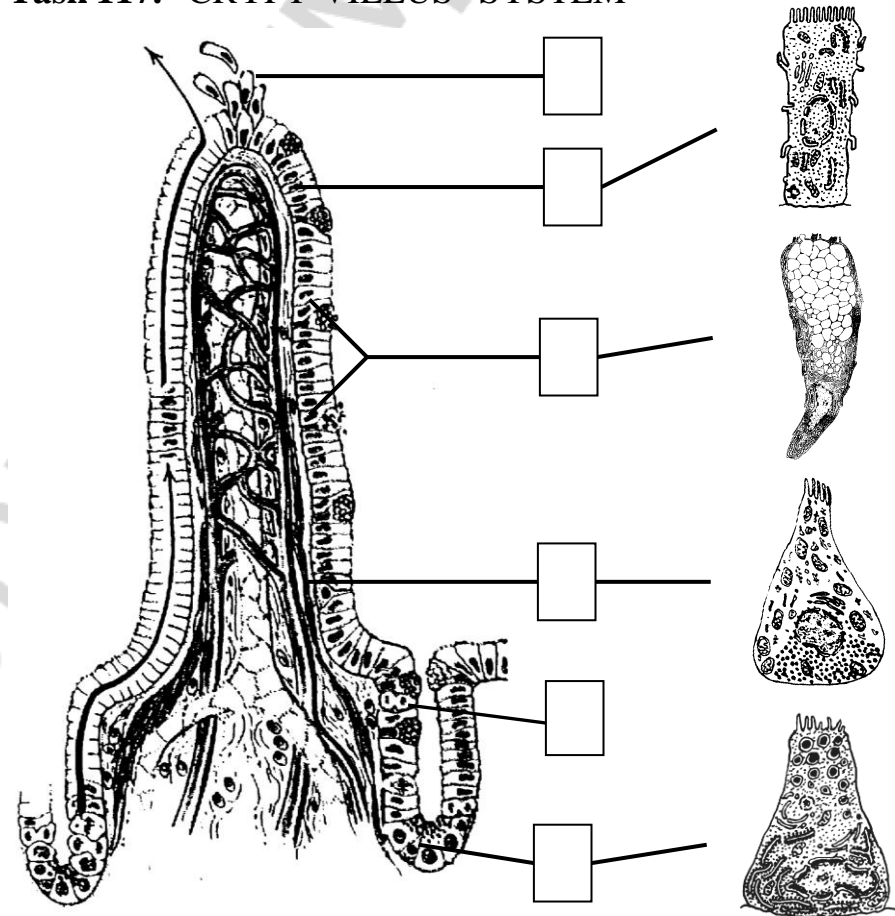
- 9 — internal circular layer;
- 10 — external longitudinal layer;

IV — intermuscular nerve plexus node (Auerbach's node);

IV — serous membrane:

- 12 — connective tissue lamina;
- 13 — mesothelium.

Task 117. "CRYPT-VILLUS" SYSTEM



Designate:

- 1 — stem cell of intestinal epithelium (mitosis);
- 2 — absorptive cells;
- 3 — goblet cell;
- 4 — Paneth cell;
- 5 — endocrine cell;
- 6 — fenestrated blood capillaries;
- 7 — lymphatic capillary;
- 8 — enterocytes exfoliation.

Task 118. DUODENUM

Staining: Hematoxylin-eosin

Magnification: 80×, 400×

Draw and designate:

I — mucous membrane:

- 1 — villus;
- 2 — crypts;
- 3 — absorptive columnar cells;
- 4 — proper lamina;
- 5 — muscular lamina;

II — submucous membrane:

- 6 — secretory portions of duodenal glands;

III — muscular membrane:

- 7 — circular layer;
- 8 — longitudinal layer;
- 9 — nerve plexus node;

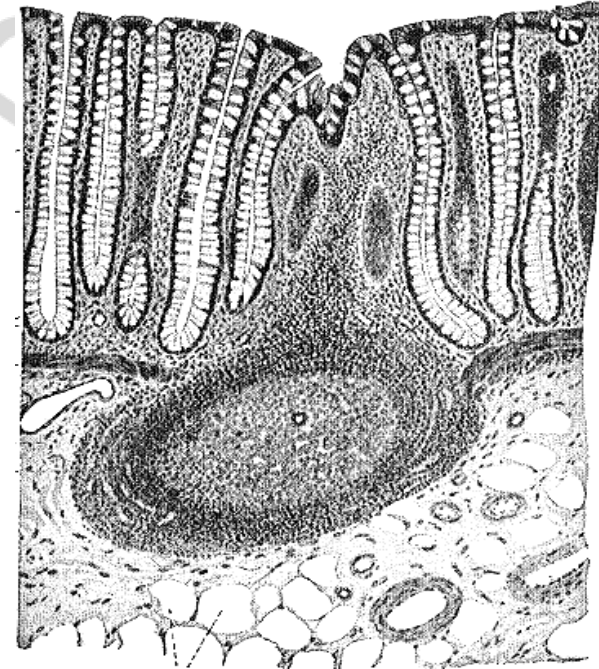
IV — serous/adventitial membrane:

- 10 — connective tissue lamina;
- 11 — mesothelial cell (in case of serous membrane).

Task 119. LARGE INTESTINE

Staining: Hematoxylin-eosin

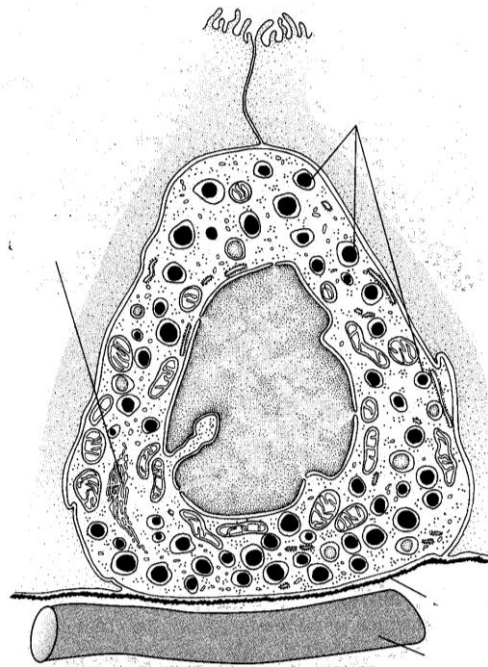
Magnification: 400×



Designate cells and structures of the mucous membrane:

- 1 — crypts;
- 2 — absorptive cells;
- 3 — goblet cells;
- 4 — proper lamina;
- 5 — muscular lamina;
- 6 — lymph nodule.

Task 120. ENDOCRINE CELL OF THE SMALL INTESTINE

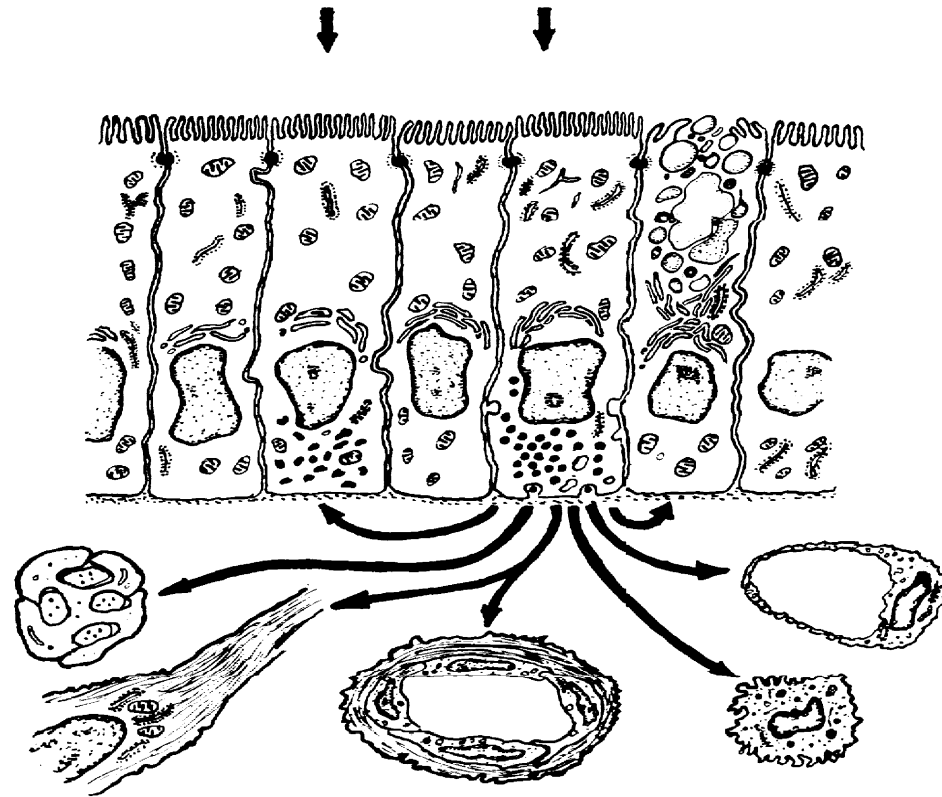


ENTEROENDOCRINE CELL

Designate:

- 1 — basement membrane;
- 2 — capillary;
- 3 — nucleus;
- 4 — secretory granules;
- 5 — Golgi complex;
- 6 — mitochondria.

Task 121. HORMONAL ACTIVITY OF INTESTINAL ENDOCRINE CELLS



Designate:

- 1 — enteroendocrine cells; 2 — adjacent enterocytes; 3 — nerve fibers; 4 — smooth muscles;
- 5 — arterioles; 6 — connective tissue cells; 7 — capillaries; 8 — goblet cell.

Task 122. THE LINING EPITHELIUM AND GLANDS IN THE DIFFERENT PARTS OF THE ALIMENTARY CANAL

Complete the table:

| | Part of the alimentary canal | Lining epithelium | Alimentary glands and its localization |
|----|------------------------------|-------------------|--|
| 1. | Oral cavity | | |
| 2. | Esophagus | | |
| 3. | Stomach | | |
| 4. | Small intestine | | |
| 5. | Large intestine | | |

Correct tasks № _____
Lecturer _____
Date « _____ » _____

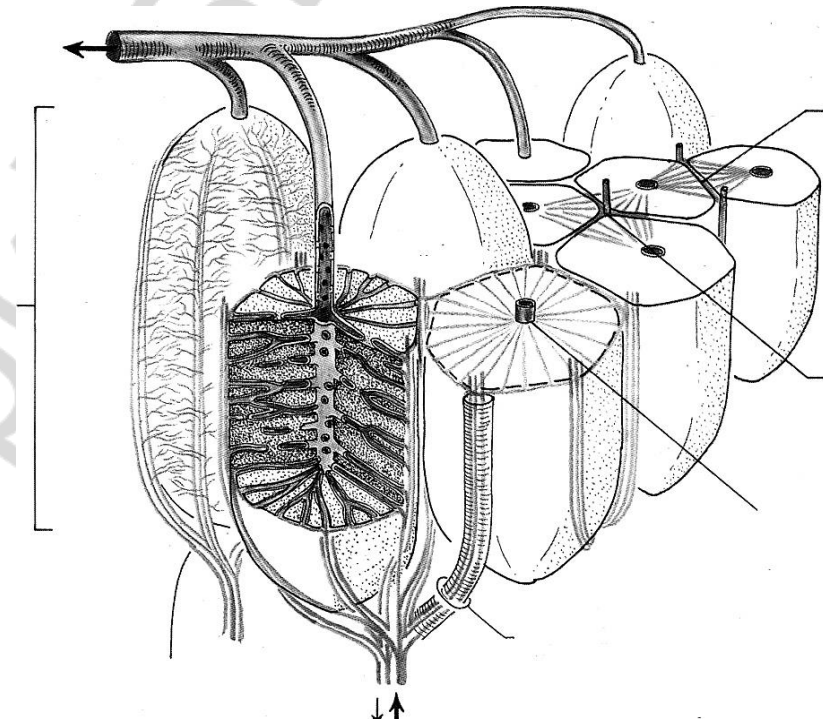
Topic 17. DIGESTIVE SYSTEM: LIVER, PANCREAS AND LARGE SALIVARY GLANDS

1. Development sources of the liver. Functions of the liver.
2. Structure of a classical hepatic lobe. The concept of portal lobe and hepatic acinus.
3. Bile ducts: structure of bile ducts and gallbladder.
4. Functions of the exocrine and endocrine portions of the pancreas.
5. The pancreas, structure of the exocrine portion of the pancreas: lobes, terminal parts, excretory ducts.
6. Pancreatic islets. Structure of the endocrine portion of the pancreas.
7. Large salivary glands. Sources of development, structure, functions.

It is recommended to revise:

Structure of exocrine and endocrine glands.

Task 123. STRUCTUREAL SCHEME OF HEPATIC PORTAL LOBE AND ACINUS



Designate:

- 1 — classic hepatic lobe;
- 2 — portal lobe;
- 3 — acinus;
- 4 — portal canal (triads);
- 5 — central vein.

Task 124. BLOOD SUPPLY OF THE LIVER

System of blood supply **TO** the liver:

- 1 –
- 2 –

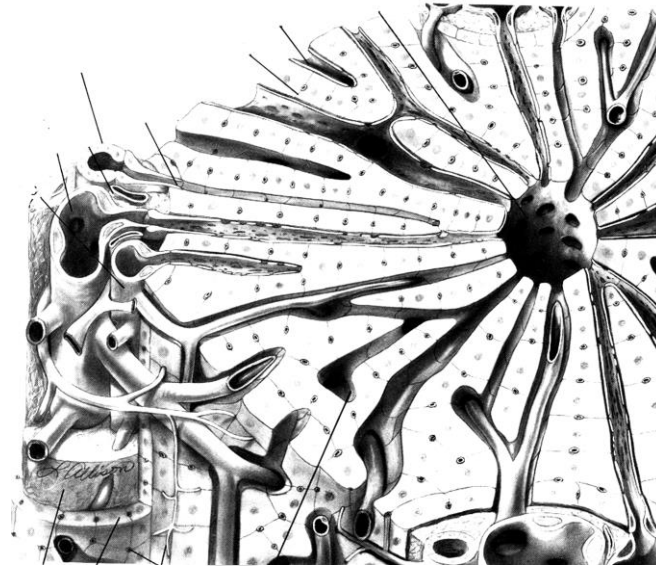
System of circulation **WITHIN** the liver:

- 1 –

System of blood **LEAVING** the liver:

- 1 –
- 2 –
- 3 –
- 4 –

Task 125. SCHEME OF HEPATIC LOBULE



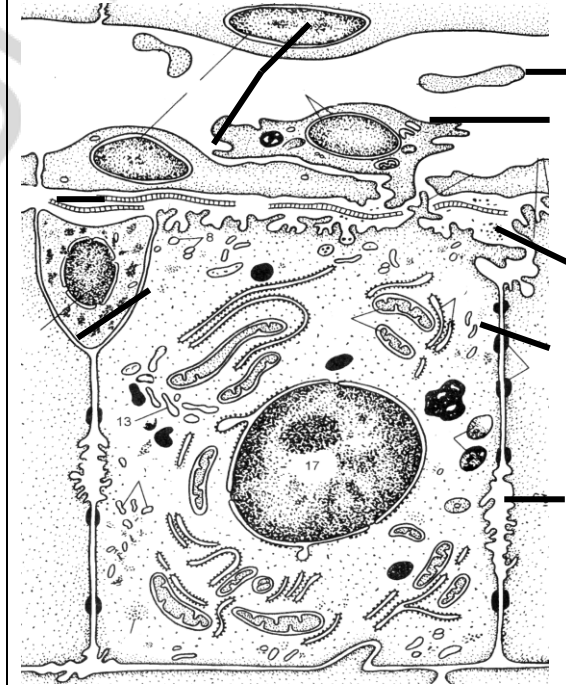
Designate:

- 1 — interlobular vein;
- 2 — interlobular artery;
- 3 — interlobular bile duct and capillaries;
- 4 — central vein.

Colour:

venous flow — in **blue**, arterial flow — in **red**,
bile ducts — in **green**.

Task 126. ULTRAMICROSCOPIC STRUCTURE OF THE LIVER



Designate:

- 1 — hepatic sinusoid;
- 2 — endothelial cells;
- 3 — macrophage;
- 4 — space of Disse;
- 5 — reticular fibers;
- 6 — Ito cell;
- 7 — tight junction (zonula occludens);
- 8 — bile canaliculus.

Task 127. LIVER OF THE PIG

Staining: Hematoxylin-eosin

Magnification: 80×, 400×



Designate:

- 1 — capsule;
- 2 — interlobular connective tissue;
- 3 — interlobular artery;
- 4 — interlobular vein,
- 5 — interlobular bile duct;
- 6 — hepatic lobe;
- 7 — central vein;
- 8 — intralobular sinusoid capillary.

Task 128. HUMAN LIVER

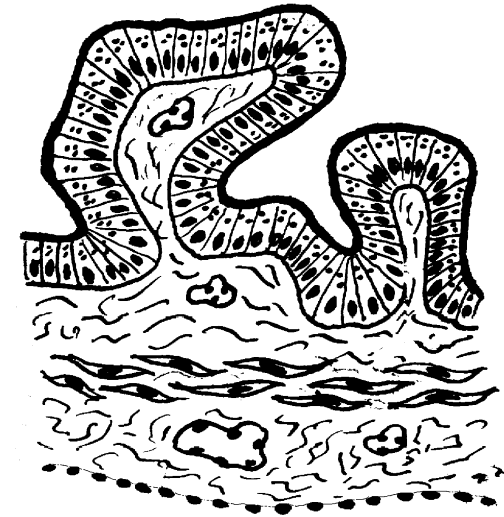
Staining: Hematoxylin-eosin

Magnification: 80×, 400×

Draw and designate:

- 1 — interlobular artery;
- 2 — interlobular vein;
- 3 — interlobular bile duct;
- 4 — central vein;
- 5 — plates of hepatocytes;
- 6 — intralobular sinusoid capillary;
- 7 — endothelial cells.

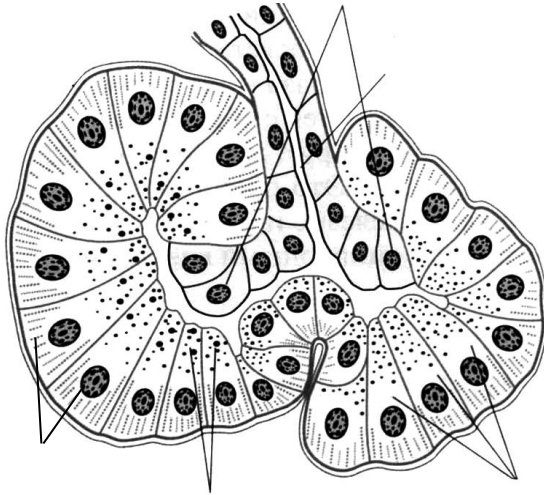
Task 129. SCHEME OF THE GALLBLADDER WALL



Designate:

- I — mucous membrane:**
- 1 — epithelial cell;
 - 2 — lamina propria.
- II — muscular membrane (coat),**
- III — serous membrane (coat):**
- 3 — mesothelium.

**Task 130. SCHEME
OF THE PANCREATIC ACINUS**



Designate:

- 1 — intercalated duct;
- 2 — centroacinar cells;
- 3 — exocrine pancreatocyte;
- 4 — secretory granules in zymogenic area;
- 5 — homogenous area.

Task 131. PANCREAS

Staining: Hematoxylin-eosin
Magnification: 80×, 400×

Draw and designate:

- 1 — interlobular connective tissue;
- 2 — interlobular excretory duct;
- 3 — interlobular artery;
- 4 — interlobular vein;
- 5 — acinus:
- a) homogenous (basophilic) basal area of the acinar cells;
- б) zymogenic (oxyphilic) apical area;
- 6 — pancreatic islet;
- 7 — blood capillaries in the islet.

**Task 132. SCHEME OF THE ENDOCRINE
PART OF PANCREAS**



Write hormones:

β -cells _____

α -cells _____

D-cells _____

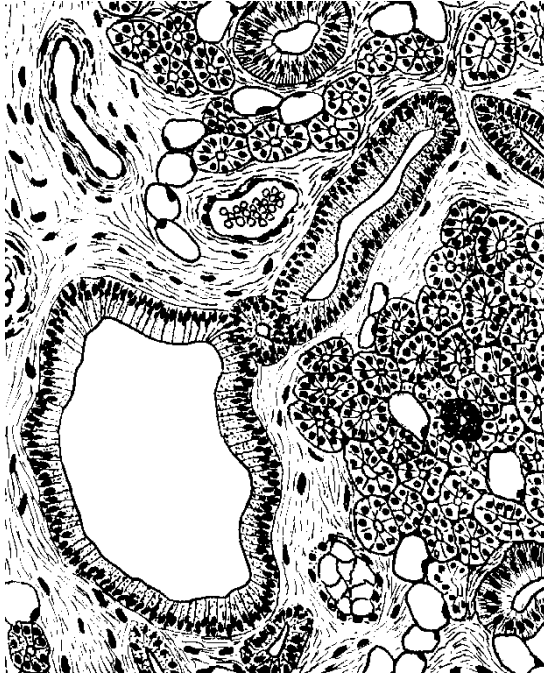
D₁-cells _____

PP-cells _____

Task 133. PAROTID GLAND

Staining: Hematoxylin-eosin

Magnification: 80×, 400×



Designate:

- 1 — interlobular connective tissue;
- 2 — interlobular excretory duct;
- 3 — protein secretory (terminal) part;
- 4 — intercalated duct;
- 5 — striated duct;
- 6 — blood vessels;
- 7 — adipose cells.

Task 134. SUBMANDIBULAR GLAND

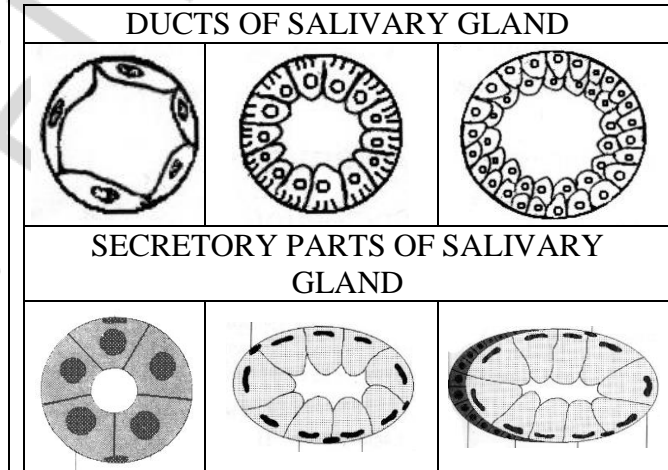
Staining: Hematoxylin-eosin

Magnification: 400×

Draw and designate:

- 1 — serous secretory part;
- 2 — serous-mucosal secretory part;
- 3 — serous demilunes;
- 4 — myoepithelial cells;
- 5 — striated duct;
- 6 — interlobular duct;
- 7 — interlobular connective tissue;
- 8 — blood vessel.

Task 135. SCHEME OF THE SALIVARY GLAND



Designate:

- 1 — intercalated duct; 5 — serous acini;
- 2 — striated duct; 6 — mixed acini;
- 3 — interlobular duct; 7 — serous demilune;
- 4 — mucous acini; 8 — myoepithelial cell.

Correct tasks № _____

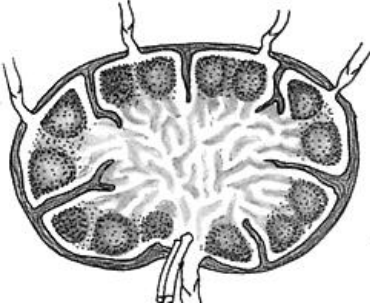
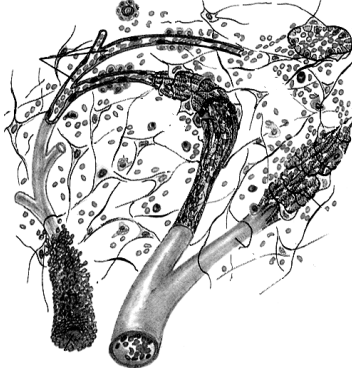
Lecturer _____

Topic 18. HEMOPOIETIC AND IMMUNOGENETIC ORGANS

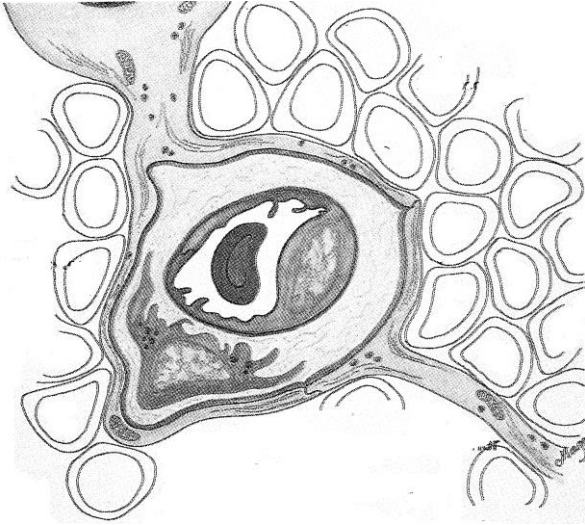
8. General morphological and functional characteristics of hemopoietic and immunogenetic organs.
9. Red bone marrow: development, structure, function. Age-related changes. Interaction of stromal and hemopoietic elements.
10. Thymus: development, structure, function. Hematohymic barrier. Conception of age-related and accidental involution.
11. Lymph nodes: development, structure, function. T- and B- areas, their dynamics in immune response.
12. Spleen: development, structure, functions, blood supply features. T- and B-areas, their dynamics in immune response.
13. Lymphoid apparatus of the digestive and respiratory systems: structure, development and function of the tonsils.

*It is recommended to revise:
structure and functions of agranulocytes,
lymphopoiesis*

Task 136. CIRCULATION ANTIGEN IN THE BODY

| <p>Step 1 antigen invades through skin and mucosa</p> | <p>Skin</p> | <p>Respiratory system</p> | <p>Digestive system</p> |
|--|--|---------------------------|-------------------------|
| <p>Step 2 if Ag doesn't eliminate in the skin and in the mucosa it leaves them, appears in lymph and enters to the lymph node</p> |  | | |
| <p>Step 3 if Ag doesn't eliminate in lymph node it leaves the lymph node, appears in blood stream and enters to the spleen</p> |  | | |

**Task 137. ELEMENTS
OF BLOOD-THYMUS BARRIER**



Color in the scheme:

reticulo-epithelial cell **in green**;
reticulo-epithelial basal lamina **in red**;
capillary basal lamina **in blue**.

Designate:

- 1 — lumen of capillary;
- 2 — capillary basal lamina;
- 3 — endotheliocyte;
- 4 — macrophage;
- 5 — reticulo-epithelial cell;
- 6 — reticulo-epithelial basal lamina;
- 7 — T-lymphocytes.

Task 138. THYMUS

Staining: Hematoxylin-eosin
Magnification: 80×, 400×

Draw and designate:

- 1 — thymic lobules;
- 2 — interlobular connective tissue;
- 3 — cortical substance;
- 4 — medullary substance;
- 5 — thymic corpuscle;
- 6 — stromal epithelial cells;
- 7 — blood vessels;
- 8 — lymphocytes.

Task 139. PALATINE TONSIL

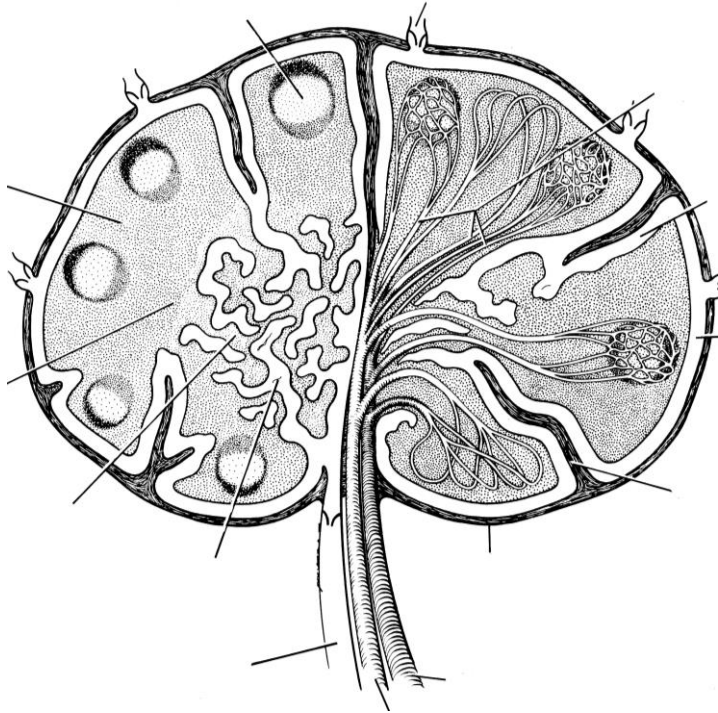
Staining: Hematoxylin-eosin
Magnification: 80×, 400×



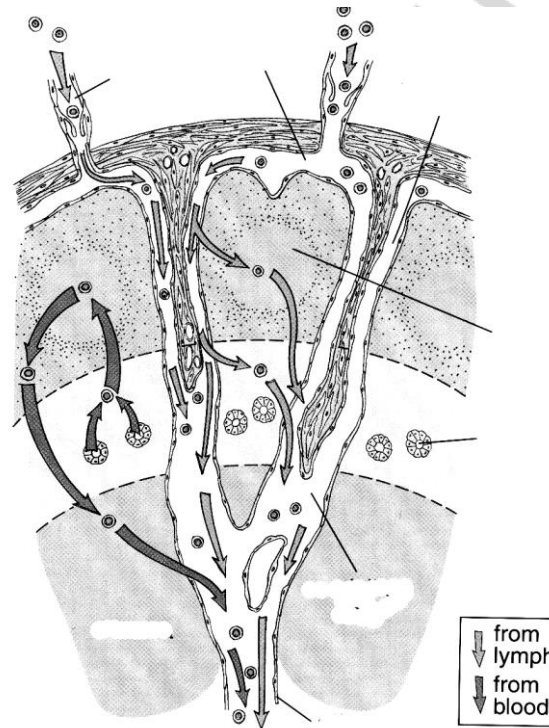
Designate:

- 1 — stratified squamous nonkeratinized epithelium;
- 2 — crypt;
- 3 — subepithelial area;
- 4 — lymphoid nodules;
- 5 — internodular areas;
- 6 — capsule;
- 7 — lymphocytes, infiltrating epithelium;
- 8 — T-area;
- 9 — B-area.

Task 140. STRUCTURAL ORGANIZATION OF LYMPH NODE



Task 141. SCHEMATIC DIAGRAM OF LYMPHOCYTE CIRCULATION WITHIN a LYMPH NODE



Task 142. LYMPH NODE

Staining: Hematoxylin-eosin
Magnification: 80×, 400×

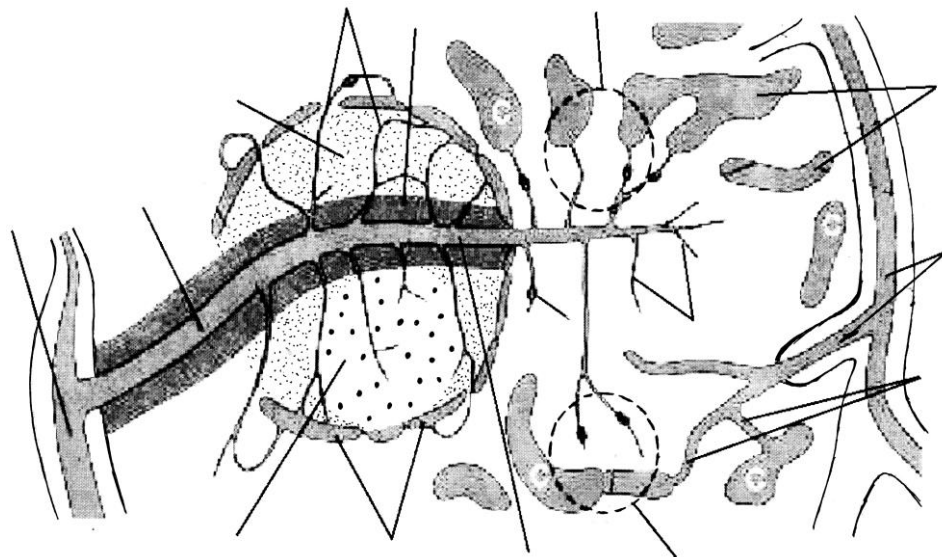
Color in the scheme:

capsule and trabeculae — **in green**; blood vessels — **in red**; B-area — **in blue**; T-area — **in brown**; lymphatic vessels and sinuses — **in yellow**.

Designate in the tasks 140, 141, 142:

1 — capsule; 2 — trabecular; 3 — subcapsular sinus; 4 — trabecular sinus; 5 — medulla sinus; 6 — cortex; 7 — lymphoid nodule: 7a — germinal centre; 7b — mantle zone; 8 — paracortex; 9 — high endothelial venules; 10 — medulla; 11 — medullae cords; 12 — artery; 13 — vein; 14 — afferent lymphatic vessel; 15 — efferent lymphatic vessel.

Task 143. STRUCTURAL ORGANIZATION OF SPLEENIC BLOOD SUPPLY



Colour:

arteries (**in red**), veins (**in blue**), venous sinuses (**in violet**).

Designate:

1 — trabeculae; 2 — trabecular arteries; 3 — pulp artery and central artery; 4 — T-zone; 5 — B-zone: 5a — germinal centre; 5b — mantle layer; 6 — marginal area with marginal sinuses; 7 — penicillar arterioles; 8 — sheathed capillaries; 9 — venous sinuses in red pulp; 10 — pulp veins; 11 — trabecular veins; 12 — open and 13 — close type of blood circulation.

Task 144. SPLEEN

Staining: Hematoxylin-eosin

Magnification: 80×, 400×

Draw and designate:

1 — capsule; 2 — trabeculae; 3 — trabecular artery; 4 — trabecular vein; 5 — element of **white pulp**: 6 — central artery; 7 — T-area; 8 — B-area: 8a — germinal centre; 8b — mantle layer; 9 — marginal area; 10 — **red pulp**; 11 — lymphocytes; 12 — erythrocytes.

Correct tasks № _____

Lecturer _____

Topic 19. ENDOCRINE SYSTEM

1. The principle of organization of endocrine regulation. The conceptions of hormones, target cells and hormone receptors.
2. Hypothalamus: structure, functions
3. Hypophysis. Source of development. Cellular structure of adenohypophysis and neurohypophysis.
4. Hypothalamic-adenohypophysial and hypothalamic-neurohypophysial systems.
5. Epiphysis. Structure. Function. Role of epiphysis in endocrine system.
6. Thyroid gland. Tissue and cell structure. Function. Peculiarities of the secretory process in thyrocytes, its regulation.
7. Parathyroid gland. Source of development, tissue and cell structure, functions, effect on calcium homeostasis
8. Adrenal glands. Source and stages of development. Structure of cortex and medullar of gland. Regulation of function.
9. Diffuse endocrine system. Types of hormone producing cells.

COMPONENTS OF ENDOCRINE SYSTEM

I. Central part:

- 1.
- 2.
- 3.

II. Peripheral part:

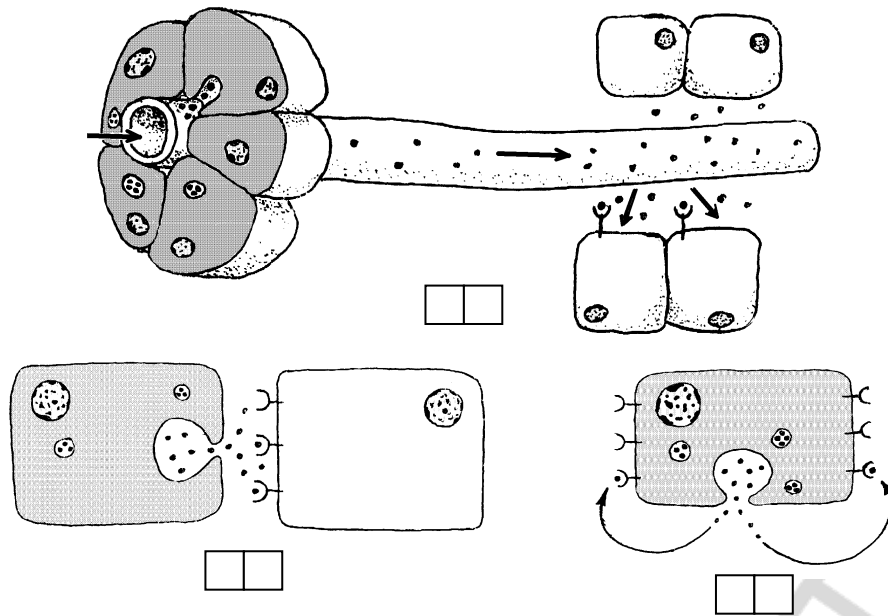
- 1.
- 2.
- 3.

III. The organs with endocrine and non-endocrine functions

- 1.
- 2.

IV. Diffuse (disperse) endocrine system.

Task 145. SCHEME OF HORMONAL EFFECTS ON TARGET CELLS



Designate:

1 — autocrine; 2 — paracrine; 3 — endocrine (distant) regulation.

Designate with letters:

- A** — inherent to anuclear embryonic and tumor cells;
- B** — provide regulation of activity level and proliferation processes in the epithelial layer;
- C** — provide integral regulation of the whole body.

Task 146. TERMINOLOGY

Learn the following terms and concepts:

ENDOCRINE — universal method of interaction between cells due to signal molecules – hormones, produced by endocrine cells.

HORMONE — biologically active substance, circulating in the body and indicating the regulatory effect on target-cells.

TARGET CELL — a cell able to recognize the presence of a hormone by means of a specific receptor and to respond by changing the function mode.

RECEPTORS — genetically determined macromolecules (proteins, glyco- and lipoproteids), localized in different parts of the cell (plasmolemma, cytoplasm, nucleus) and specialized in perceiving biologically important signals of chemical and physical origin.

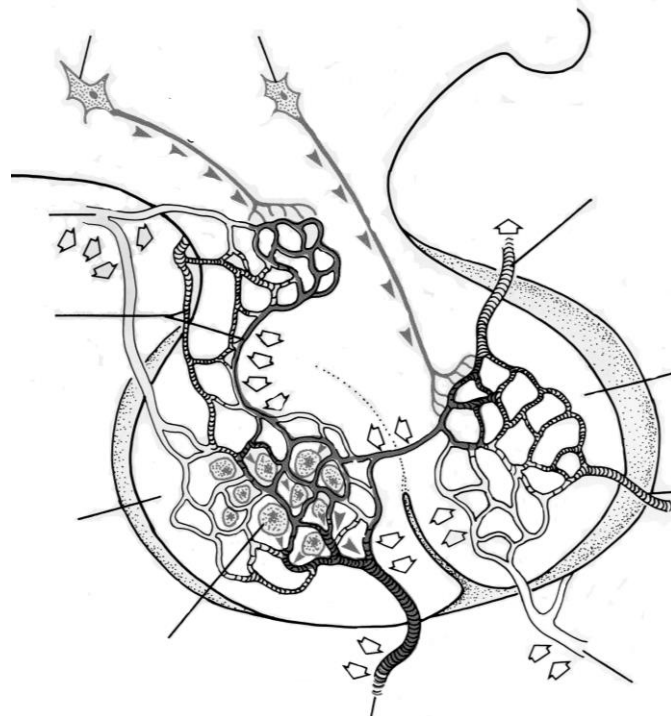
LIGAND — a molecule (hormone, growth factor, cytokine), specifically binding to the receptor.

Give the definition of the terms:

Autocrine — _____

Paracrine — _____

Task 147. HYPOTHALAMO-ADENOHYPHYSAL SYSTEM



Designate:

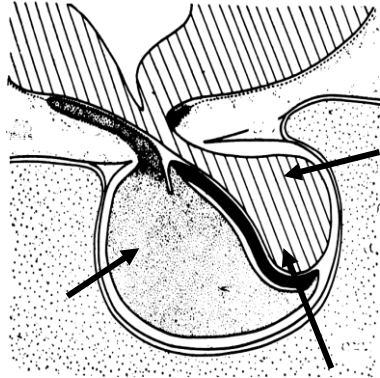
- 1 — neurosecretory cells of anterior hypothalamus;
- 2 — neurosecretory cells of median hypothalamus;
- 3 — primary capillary plexus;
- 4 — axons of neurosecretory cell;
- 5 — median eminence;
- 6 — secondary capillaries plexus;
- 7 — cells of adenohypophysis;
- 8 — pars posterior of hypophysis;
- 9 — axo-vascular synapse.

| Hormones of adenohypophysis | Target organs | Hormones of neurohypophysis | Target organ |
|--------------------------------|---------------|-----------------------------|--------------|
| Basophilic cells | | 1. | |
| 1. | | | |
| 2. | | | |
| | | | |
| Acidophilic cells | | 2. | |
| 1. | | | |
| 2. | | | |
| Adrenocorticotropocytes | | | |

Task 148. HYPOPHYSIS

Staining: Hematoxylin-eosin

Magnification: 400×



Designate:

- 1 — anterior lobe;
- 2 — posterior lobe;
- 3 — intermedia lobe;
- 4 — hypothalamus.

Draw and designate:

- I. Anterior lobe:
 - 1 — oxyphilic adenocytes;
 - 2 — basophilic adenocytes;
 - 3 — chromophobic adenocytes.
- II. Intermedia lobe.
- III. Posterior lobe.

Task 149. ADRENAL GLAND

Staining: Hematoxylin-eosin

Magnification: 400×

Regulation of adrenal gland

1. Zona glomerulosa —

2. Zona fasciculate —

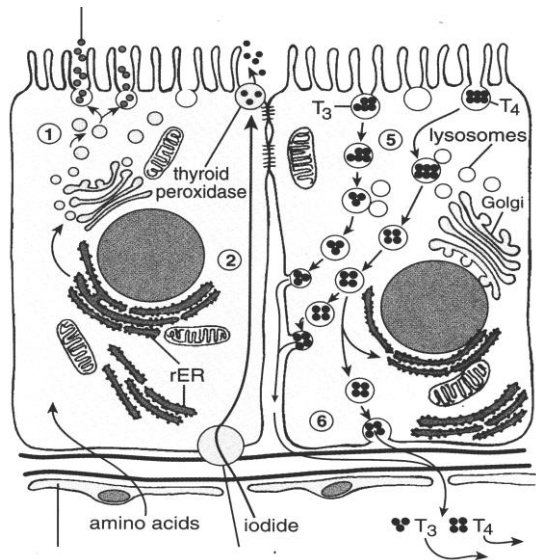
3. Zona reticularis —

Medulla

Draw, designate and write hormones:

- 1 — capsule;
- 2 — zona glomerulosa _____
- 3 — zona fasciculate _____
- 4 — zona reticularis _____
- 5 — medulla _____

Task 150. SCHEME OF HORMONOGENESIS IN THE THYROID GLAND



Designate:

- 1 — uptake of circulating iodide;
- 2 — synthesis of thyroglobulin;
- 3 — iodination of thyroglobulin;
- 4 — intrafollicular colloid phagocytosis;
- 5 — fusion of colloid drop with lysosome excretion of thyroxine into the capillary;
- 6 — closing lamina (tight junction).

Correct tasks № _____

Lecturer _____

Task 151. THYROID AND PARATHYROID GLANDS

Staining: Hematoxylin-eosin

Magnification: 80×, 400×

**Regulation of thyroid gland
(Fill in the table at home)**

Organ _____
Hormones _____



Organ _____
Hormone _____



Organ thyroid gland
Hormones _____



Effect on organ target cells

Designate:

- 1 — glandular capsule;
- 2 — follicular epithelium;
- 3 — interfollicular epithelium;
- 4 — colloid;
- 5 — resorption vacuoles;
- 6 — parathyroid glandular cell cords.

Topic 20. NERVOUS SYSTEM. PERIPHERAL NERVOUS SYSTEM

1. General morphological and functional characteristics of the nervous system. Sources of development. Classification.
2. Neuronal theory. Conception of nerve centers, their classification, principles of structural organization.
3. Reflex arch, its structural unit. Types of reflex arches.
4. Cerebrospinal ganglia: sources of development, structure, function.
5. Spinal cord. Its development. The structure of grey and white matter. Neuron structure.
6. Peripheral nervous system. Nerve, its structure and Regeneration.
7. Autonomous (vegetative) nervous system: extra- and intramural ganglia.

Revise the nervous tissue.

MAIN PRINCIPALES OF THE NERVOUS SYSTEM ORGANIZATION

Neuron theory is a basis of organization nervous system.

Statements of neuron theory

Morphological basis

1. Neuron is a structural, functional, genetic, trophic unit of nervous system.
2. Anatomically neurons are separated from each other. Neurons interact with each other with the help of synapses.
3. Neurons are a basis for pathology reactions.

Physiological basis

1. Neuron is polar. Dendrites conduct the impulses to the cell body, axon conducts the impulses away from the cell body.
2. Neurons may be in state of inhibition or excitation.

Task 152. NEURON INTEGRATION

Interaction between neurons is **neuron intergration**.
Neuron integration occurs on basis of such processes as
DIVERGENCE (A) _____

CONVERGENCE (B) _____

Neuron integration proposes the forming of **nerve centre**.

NERVE CENTER is a structural and functional union of neurons. Synaptic transmission takes place here.

Nerve centers are divided into a nuclear nerve center and a screen nerve centers.

NUCLEAR NERVE CENTER

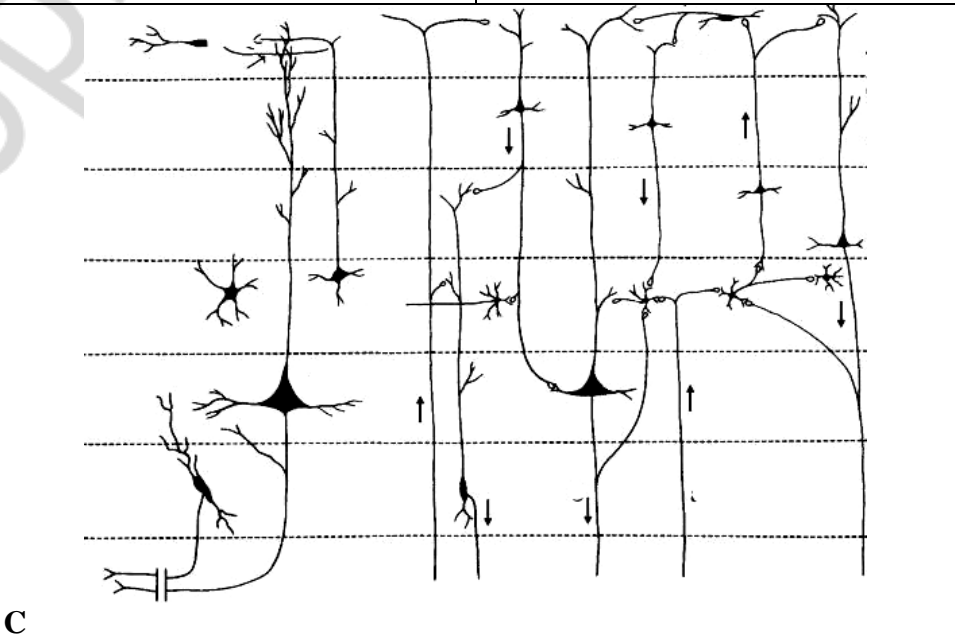
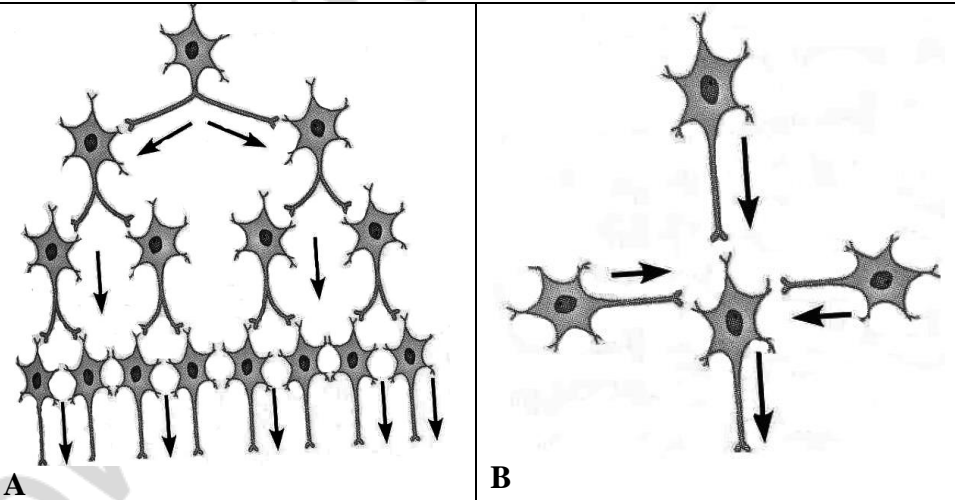
1. Neurons form compact groups.
2. There are processes of convergence from an afferent system.
3. There is only one type of neuron.

Nuclear nerve centers are ganglions in PNS, and nuclei in CNS.

SCREEN (PLAN) NERVE CENTER (C)

1. Neurons are placed regularly, by layers.
2. There are predominant processes of divergence.
3. There are functionally different types of neurons.

Screen nerve centers are cerebral cortex, cerebellum cortex and retina.



Task 153. REFLEX ARCS

REFLEX ARC is a chain of neurons, it consists of

1. receptor (dendrite of sensory neurons);
2. afferent neurons;
3. associative neurons;
4. efferent neurons;
5. efferent nerve endings
(axon of efferent neurons: motor end plate).

A

B

C

Draw and designate:

A — somatic reflex arc, B — sympathetic, C — parasympathetic reflex arcs

1 — sensory nerve ending; 2 — sensory neuron of the spinal ganglion; 3 — intercalated multipolar neuron; 4 — motor neurons; 5 — motor nerve endings, 6 — intercalated multipolar neuron of the lateral horn nucleus; 7 — efferent multipolar neuron (Dogel I type); 8 — preganglionic fibers (in red); 9 — postganglionic fibers (in blue).

Task 154. SPINAL GANGLION

Staining: Hematoxylin-eosin

Magnification: 400×

Draw and designate:

1 — pseudounipolar neuron; 2 — blood capillaries; 3 — oligodendroglial nuclei (satellite cell).

Correct tasks № _____

Lecturer _____

Task 155. CROSS SECTION OF PERIPHERAL NERVE

Staining: Hematoxylin-eosin

Magnification: 400×

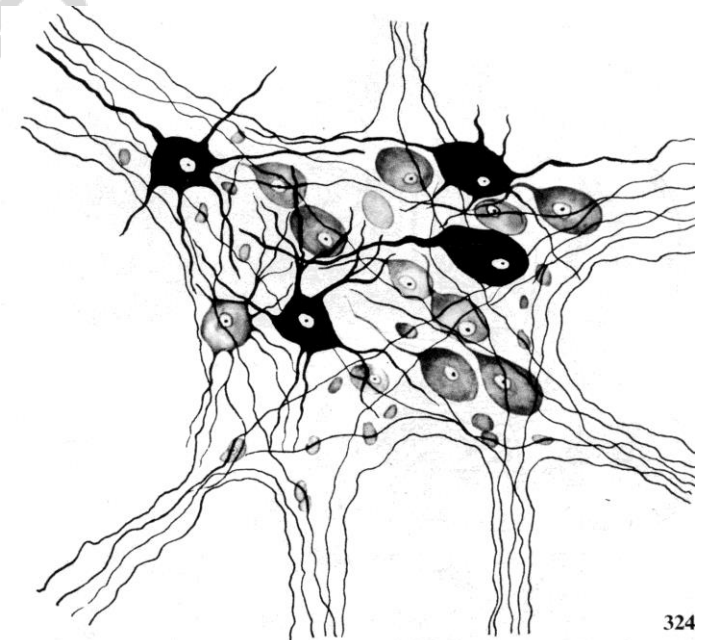
Draw and designate:

1 — bundles of nerve fibers; 2 — endoneurium; 3 — perineurium; 4 — epineurium; 5 — adipose cells.

Task 156. GANGLION. Of VEGETATIVE NERVOUS SYSTEM

Staining: Impregnation with silver

Magnification: 400×



324

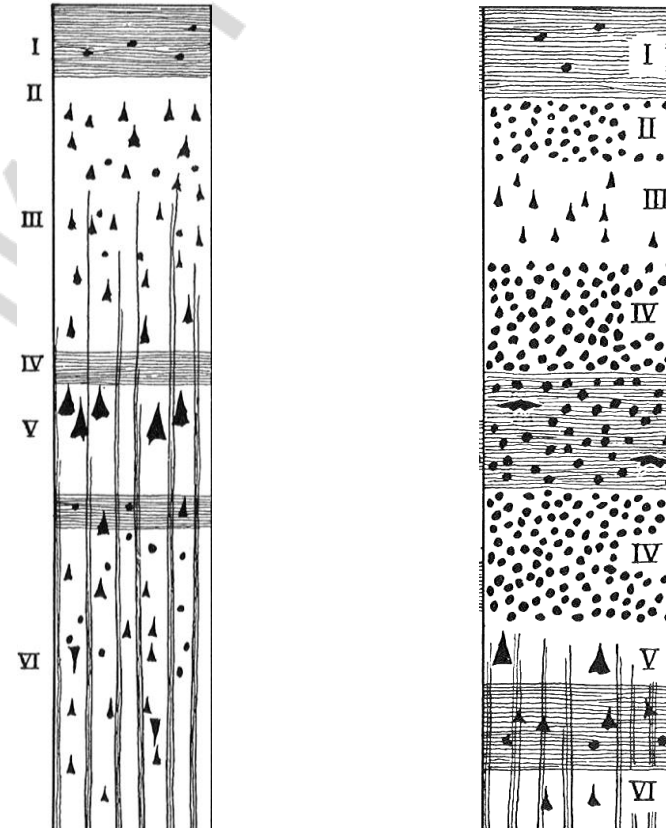
Designate:

1 — long-axon nerve cell (Dogel I) type;
2 — equal length of processes nerve cell (Dogel 2);
3 — nerve fibers;
4 — nuclei of glial cells.

Topic 21. NERVOUS SYSTEM. CENTRAL NERVOUS SYSTEM

8. Embryonal development of the brain
9. Brain. Cerebral hemispheres, sources of embryonic development. Histogenesis. Neuronal organization of the cerebral cortex. Cyto- and myeloarchitechure. Conception of modules and columns.
10. Cerebellum. Structure and functional characteristics.
11. Brainstem. Sources of development. Grey and white matter. Organization principles of ascending and descending passageways. Medulla, nuclei. Reticular formation: structure and functions.

Task 157. TYPE OF CORTEX CEREBRAL HEMISPHERES



Characteristic of agranular cortex

Characteristic of granular cortex

Correct tasks № _____

Lecturer _____

Task 158. CEREBRAL CORTEX

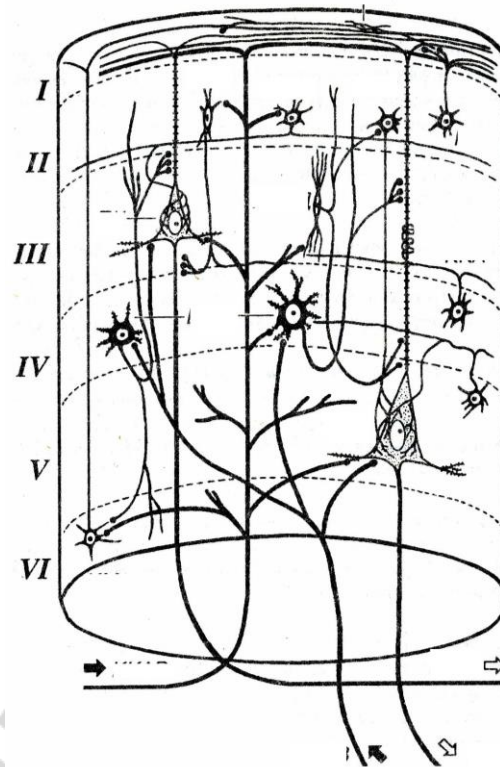
Staining: Impregnation with silver

Magnification: 80×, 400×

Draw and designate:

- 1 — molecular layer;
- 2 — external granular layer;
- 3 — external pyramidal layer;
- 4 — internal granular layer;
- 5 — internal pyramidal layer;
- 6 — polymorphic (multiform) cell layer;
- 7 — white matter of the hemispheres.

Task 159. SCHEMATIC DRAWING OF BRAIN CORTEX COLUMN (MODULE)



Structural component of module

| | |
|-------------------------------|--------------------|
| Input of information | |
| Zone of information treatment | Inhibition neurons |
| | Exciting neurons |
| Exit of analyzed information | |

Draw and designate:

- 1 — stellatar neuron; 2 — pyramidal neuron; 3 — afferent fibers (**green**); 4 — efferent pathway (**red**).

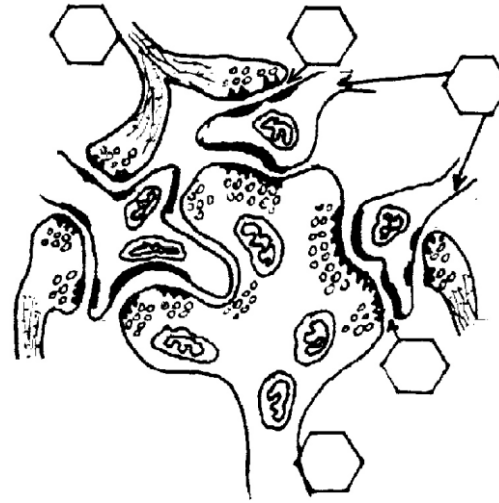
Task 160. TRANSVERSE SECTION OF CEREBELLUM

Staining: Impregnation with silver
Magnification: 400×

Draw and designate:

I — molecular layer: 1 — basket cell;
2 — stellatar cell; 3 — dendrite Purkinje cell;
4 — climbing fibers; 5 — parallel fibers;
II — ganglionic layer: 6 — Purkinje cell
bodies; 7 — baskets of nerve fibers;
III — granular layer: 8 — nuclei of granule-
cells and Golgi's cells; 9 — mossy fiber.

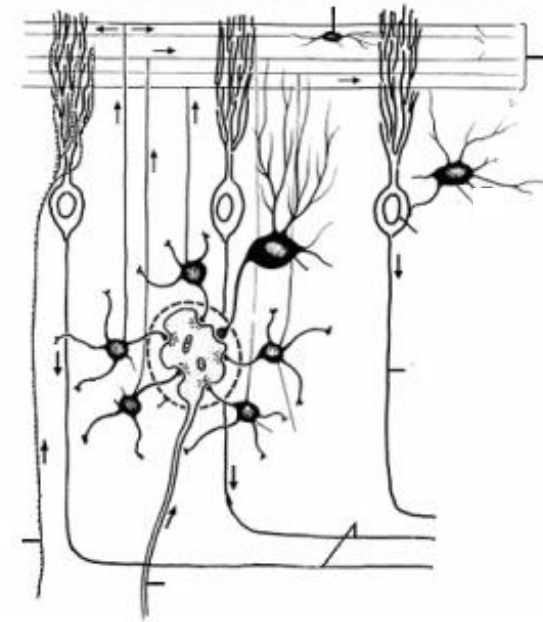
Task 161. CEREBELLAR GLOMERULUS



Color and designate:

1 — the rosette of mossy fibers
(brown); 2 — dendrites of granule
cells (green); 3 — the axon of Golgi
cells; 4 — exciting axo-dendritic syn-
apse; 5 — inhibition synapse.

Task 162. INTERACTION BETWEEN NEURONS AND AFFERENT FIBRES IN NEURON ENSEMBLES OF CEREBELLAR CORTEX (after J. Eccles)



Designate:

1 — Purkinje cell; 2 — basket cell; 3 — stellate cell;
4 — granule cell; 5 — Golgi cell; 6 — climbing fiber;
7 — mossy fiber; 8 — Purkinje cell axons; 9 — paral-
lel fibers of molecular layer.

Topic 22. SENSE ORGANS

1. Sense organs. General morphological and functional characteristics. Conception of analyzer, its structure.
2. Classification, structure and cytophysiology of receptor cells.
3. The organ of smell: structure, sources of development, cytophysiology of neurosensory receptor cells.
4. The organ of vision. Sources of development and basic stages of embryogenesis.
5. The main functional apparatuses of the eye. Structure of the refractive and accommodative apparatuses of the eye ball. Their age-specific changes.
6. The receptive apparatus: development, structure, and adaptation of the retina to the level of light. Specialized regions of the retina. Types of neurosensory receptor cells.
7. The organ of taste: source of development, structure, cytophysiology of taste receptor cells.
8. The organ of hearing. Morphological and functional characteristics. Sources of development, structure, cytophysiology of sensoepithelial receptor cells of the spiral organ.
9. The organ of equilibrium. Sources of development, structure, functions. Morphological and functional characteristic of sensoepithelial receptor cells.

Definition of "Sense organ": _____

The main functional apparatuses of the eye:

1 — refractive apparatus

includes:

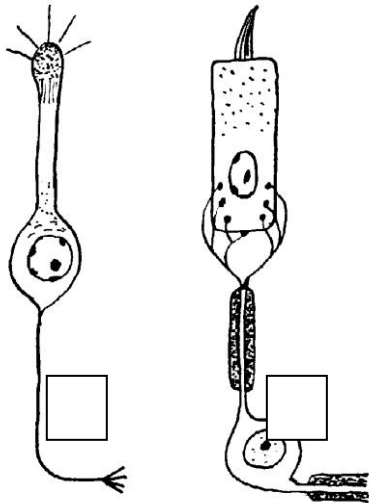
2 — accommodative apparatus

includes:

3 — receptive apparatus

includes:

Task 163. RECEPTOR CELLS

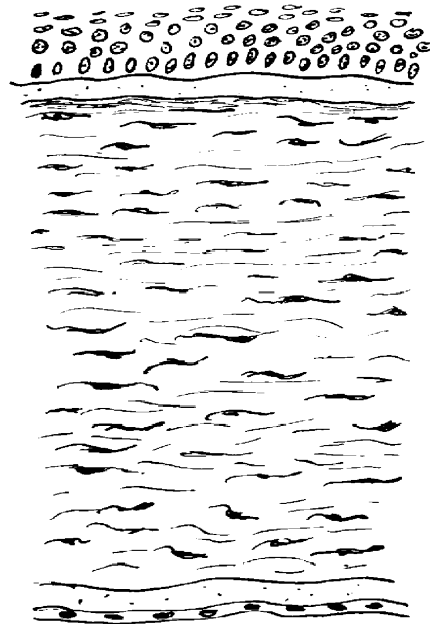


Designate neurosensory (1) and sensoepithelial (2) cells. Indicate their location:

- I. 1 —
2 —
II. 1 —
2 —
3 —

Task 164. CORNEA

Staining: Hematoxylin-eosin
Magnification: 80×, 400×

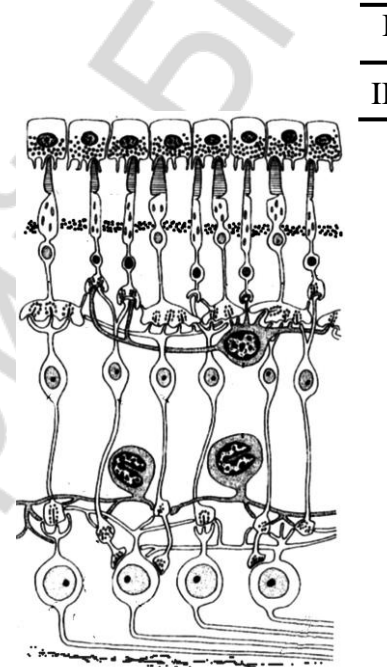


Designate:

1 — nonkeratinized stratified squamous epithelium; 2 — anterior basement membrane (Bowman's membrane); 3 — substantia propria of the cornea; 4 — posterior basement membrane (Descemet's membrane); 5 — posterior epithelium of the cornea (endothelium).

Task 165. POSTERIOR WALL OF THE EYE

Staining: Hematoxylin-eosin
Magnification: 80×, 400×

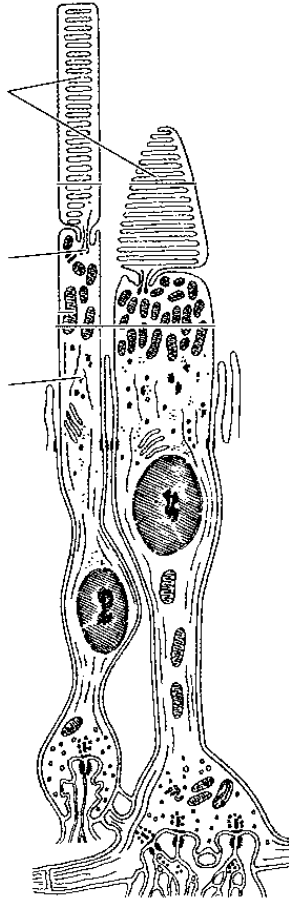


Draw eye wall sections (in darkness and in light) and designate in the picture and in the diagram:

I — sclera; II — choroid: II a — blood vessels; II b — pigmental tissue; **III — retina:**

- | | |
|---------------------------------|----------------------------------|
| 1 — pigmental epithelium; | 6 — inner nuclear layer; |
| 2 — layer of rods and cones; | 7 — inner plexiform layer; |
| 3 — external limiting membrane; | 8 — layer of ganglion cells; |
| 4 — outer nuclear layer; | 9 — nerve fiber layer; |
| 5 — outer plexiform layer; | 10 — internal limiting membrane. |

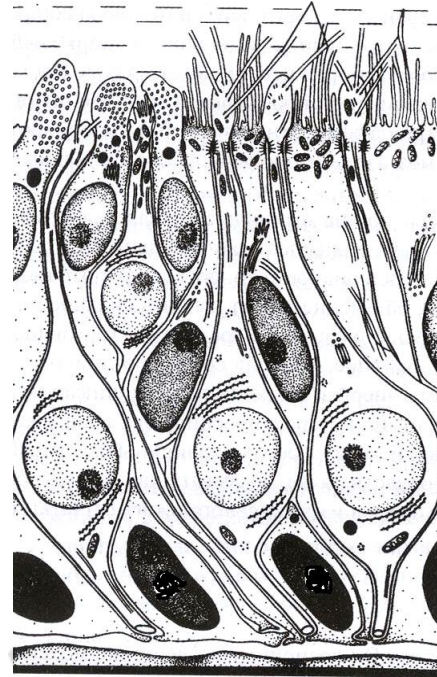
Task 166. ULTRASTRUCTURE OF ROD AND CONE



Designate:

I — rod: 1 — outer segments; 2 — inner segment;
3 — mitochondria; 4 — nuclei;
II — cone: 5 — cilium; 6 — synapses with bipolar cells.

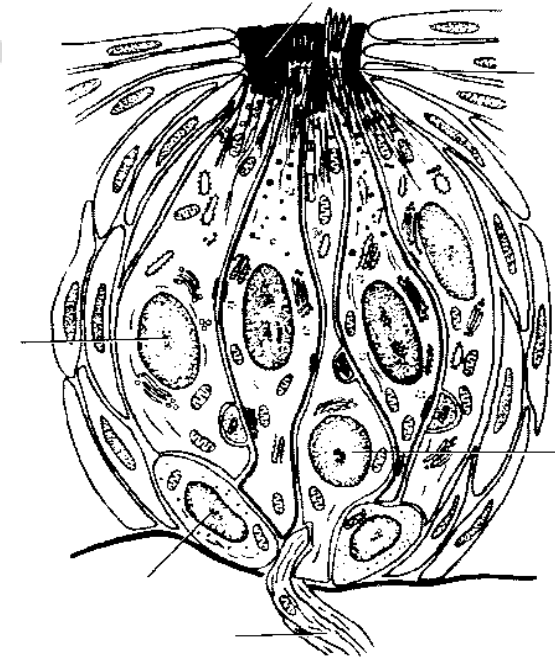
Task 167. OLFFACTORY AREA OF THE NASAL CAVITY



Designate:

1 — olfactory cell;
2 — apexes with cilia;
3 — supporting cells;
4 — microvilli;
5 — basal cells.

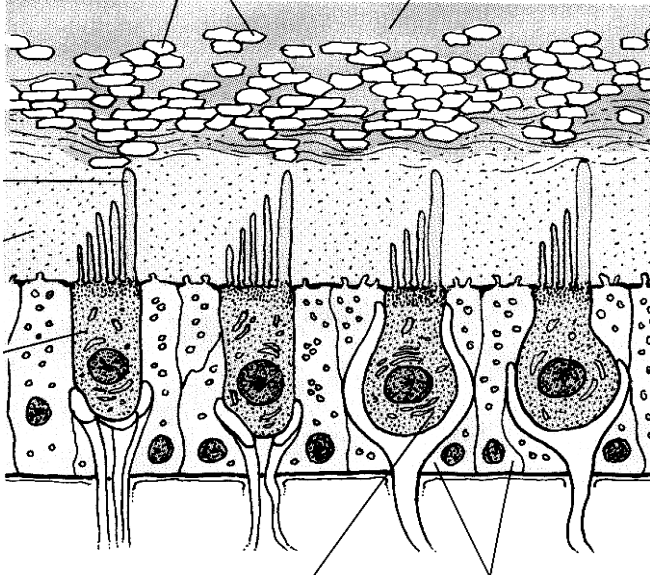
Task 168. SCHEME OF A TASTE BUD



Designate:

1 — taste pore;
2 — microvilli;
3 — taste cell;
4 — supporting cell;
5 — basal cell;
6 — afferent nerve fiber.

Task 169. SCHEME OF A MACULA WITHIN THE UTRICLE



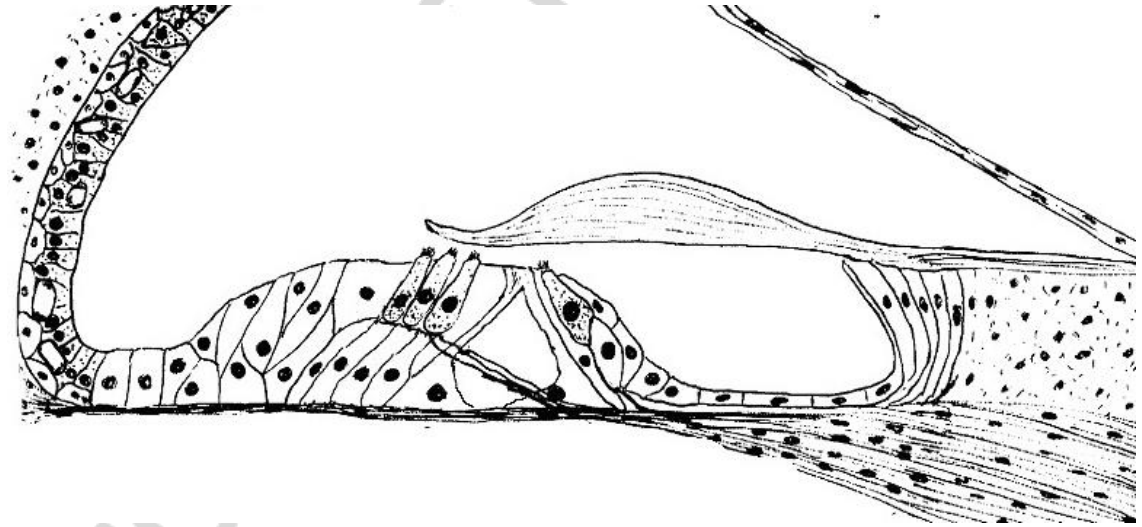
Designate:

1 — type I hair (sensory) cell; 2 — type II hair cell;
 3 — supporting epithelial cells; 4 — kinocilium; 5 —
 nerve endings; 6 — otolithic membrane; 7 — oto-
 conia; 8 — endolymph.

Task 170. SPIRAL ORGAN

Staining: Hematoxilin-eosin

Magnification: 400×



Designate:

| | |
|-----------------------------|-----------------------------------|
| 1 — outer hair cells; | 11 — stria vascularis epithelium; |
| 2 — inner hair cells; | 12 — capillaries; |
| 3 — outer supporting cells; | 13 — spiral ligament. |
| 4 — inner supporting cells; | |
| 5 — outer pillar cell; | |
| 6 — inner pillar cell; | |
| 7 — tunnel; | |
| 8 — tectorial membrane; | |
| 9 — basilar membrane; | |
| 10 — vestibular membrane; | |

Correct tasks № _____

Lecturer _____

Topic 23. URINARY SYSTEM

1. The sources of embryonic development and the principal stages of ontogenesis of the kidney (pronephros, mesonephros and metanephros).
2. The structure of the kidney (cortical and medullary substances). Nephrons and urinary tracts. The structure and function of cortical and juxtamedullary nephrons.
3. Histophysiology of the glomerulus. Filtering barrier (renal histohematogenous barrier).
4. Histophysiology of different portions of the nephron (proximal part, thin tubule, distal part) and collecting tubules.
5. Renal endocrine complexes and its histophysiology.
6. Blood supply of the kidney. Characteristics of cortical and juxtamedullary circulation. The lymphatic system of the kidney. Innervation of the kidney.
7. Kidney of a newborn. Age-related characteristics of the kidney.
8. The urinary tract. Development and structure of the renal pelvis, ureter and urinary bladder. Their functional significance.

It is recommended to revise:

1. The classification, morphological and physiological characteristics of epithelial tissue. The structure of transitional epithelium.
2. The structure of smooth muscular tissue.

The principal stages of embryonic kidney's development:

- 1.
- 2.
- 3.

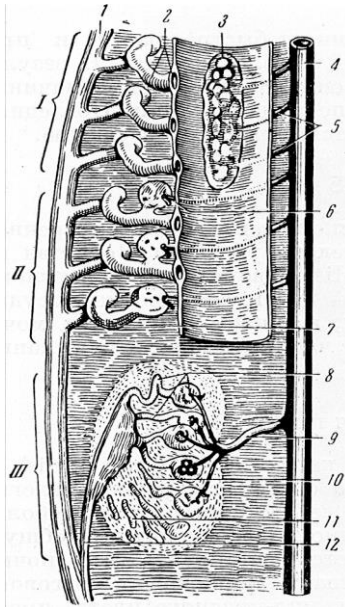
The main function of the kidney

Definition of the term "Nephron":

The types of nephrons:

- 1.
- 2.
- 3.

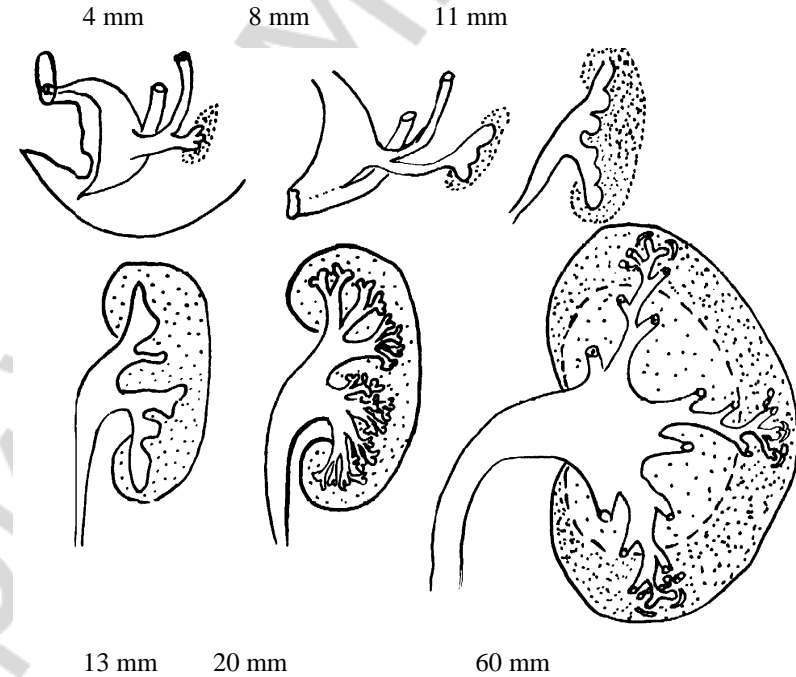
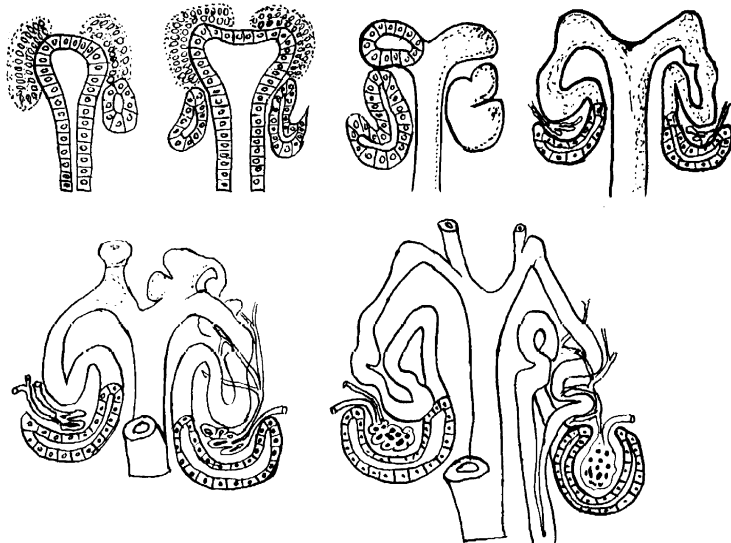
Task 171. EMBRYONAL DEVELOPMENT OF A KIDNEY



A. Three generations of the kidneys

Designate and color:

- I — pronephros (in red);
- II — mesonephros (in green)
- III — metanephros (in blue);
- 1 — mesonephric (Wolffian) duct (in yellow);
- 2 — aorta;
- 3 — coelom.



↑ B. Development of the human metanephros:

Designate and color:

- 1 — cloaca;
- 2 — Wolffian duct;
- 3 — diverticulum of Wolffian duct (in yellow);
- 4 — nephrogenic tissue (in blue).

⇐ C. Sequential stages of nephron development

Designate and color:

- 1 — diverticulum of Wolffian duct (in yellow);
- 2 — derivatives of nephrogenic tissue (in blue);
- 3 — blood vessels (in red).

Task 172. SCHEME OF NEPHRON STRUCTURE

Mark cortical and medullary substances.

Designate and color:

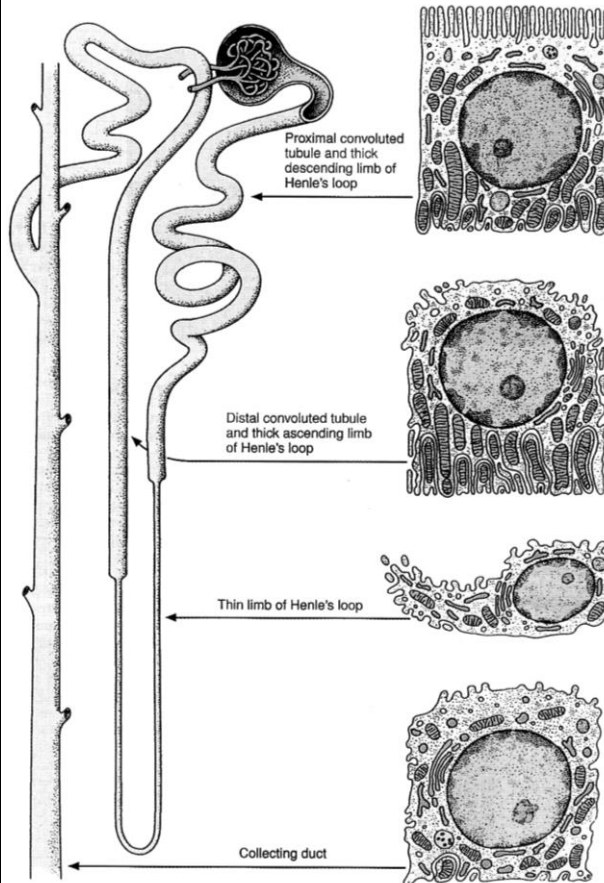
In picture A: nephron structures:

1 — renal corpuscle; 2 — proximal convoluted renal tubule (**in dark green**); 3 — proximal straight renal tubule (**in light green**); 4 — thin tubule of Henle's loop (**in brown**): a) descending part; b) ascending part; 5 — distal straight tubule of Henle's loop (**in grey**); 6 — distal convoluted tubule (**in lilac**); **and structures of urinary tracts:** 7 — collecting tubule (**in yellow**); 8 — papillary canal;

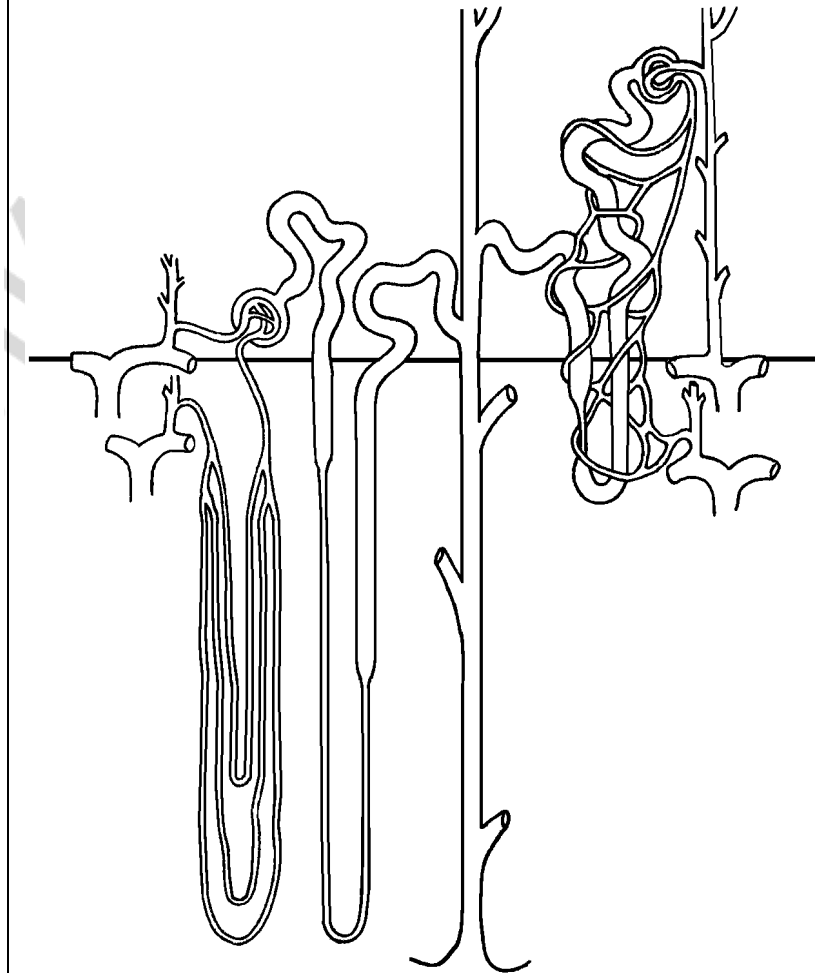
In picture B: vessels:

1 — interlobar artery; 2 — arcuate artery; 3 — interlobular artery; 4 — afferent arteriole; 5 — glomerular capillaries; 6 — efferent arteriole; 7 — peritubular capillaries; 8 — vasa recta; 9 — interlobular vein; 10 — arcuate vein; 11 — interlobar vein.

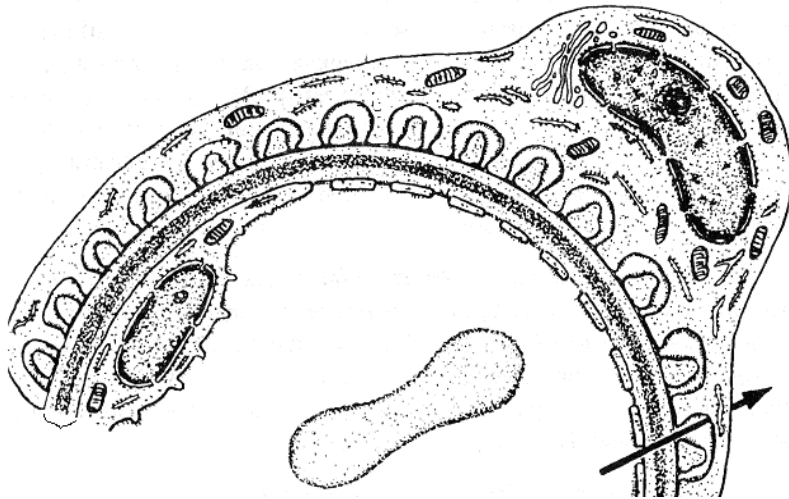
A. Cellular ultrastructure of the different parts of nephron



B. Types of nephrons and their blood supply



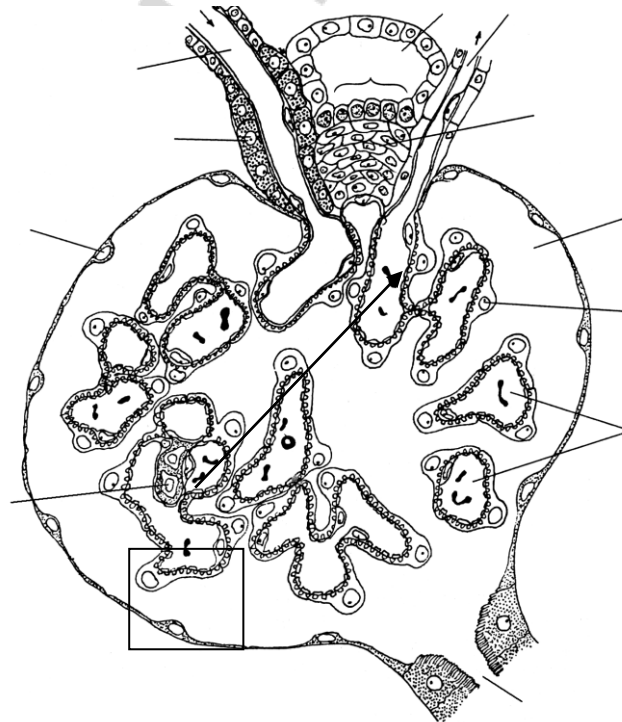
Task 173. RENAL FILTERING BARRIER (scheme)



Designate and color:

- 1 — endothelial capillary cells of vascular glomerulus with fenestras **(in pink)**;
- 2 — basal membrane **(in yellow)**;
- 3 — podocyte of internal layer in glomerular capsule **(in grey)**;
- 4 — blood capillary lumen **(in red)**;
- 5 — capsule cavity of renal corpuscle **(in green)**.

Task 174. RENAL CORPUSCLE AND JUXTA-GLOMERULAR APPARATUS (scheme)



Designate and color:

- Vessels — **in red**, capsule cavity — **in green**, juxtaglomerular apparatus units — **in blue**.
- 1 — afferent arteriole; 2 — efferent arteriole; 3 — glomerular capillaries;
 - 4 — parietal layer of glomerular capsule; 5 — visceral layer of glomerular;
 - 6 — capsule cavity; 7 — proximal tubule; 8 — distal convoluted tubule;
 - 9 — juxtaglomerular cells; 10 — cells of macula densa; 11 — juxtavascular cells; 12 — mesangial cells.

Task 175. KIDNEY

Staining: Hematoxylin-eosin

Magnification: 400×

Draw and designate:

Renal corpuscle: 1 — cells of external capsular layer; 2 — capsule cavity; 3 — vascular glomerulus;

Renal tubules: 4 — proximal renal tubule; 5 — brush border of proximal renal tubule cells; 6 — thin tubule of Henle's loop; 7 — distal straight renal tubule; 8 — distal convoluted renal tubule; 9 — collecting tubules.

Vessels: 10 — artery; 11 — vein.

Task 176. URINARY BLADDER

Staining: Hematoxylin-eosin

Magnification: 80×



Correct tasks № _____

Lecturer _____

Task 177. URETER

Staining: Hematoxylin-eosin

Magnification: 80×

Designate in the tasks “Urinary bladder” and “Ureter”:

I — Mucous membrane:

1 — transitional epithelium;

2 — lamina propria.

II — Submucous membrane:

3 — blood vessels.

III — Muscular membrane:

4 — internal longitudinal layer;

4a (for task 176) — circular layer;

5 — external circular (for task 176 longitudinal) layer;

6 — nerve intramural ganglion.

IV — Serous or adventitial membrane:

7 — adipose cells;

8 — mesothelial cells.

Topic 24. MALE REPRODUCTIVE SYSTEM

Male reproductive system, its structure and functions.
Development of the male reproductive organs.

Testis: development, structure, generative and endocrine functions of the testis. Hemato-testicular barrier.

Spermatogenesis, its periods, regulation.

Seminal ducts of the male reproductive system: straight tubules, rete testis, efferent ductules, epididymis, ductus deferens, ejaculatory duct. Development, structure, functions.

Accessory glands of the male reproductive system: prostate (prostatic gland), seminal vesicles, bulb-urethral glands. Development, structure, functions. Age-related changes. Seminal fluid, its structure.

It is recommended to revise:

1. Cell division: meiosis.

Development of the excretory system.

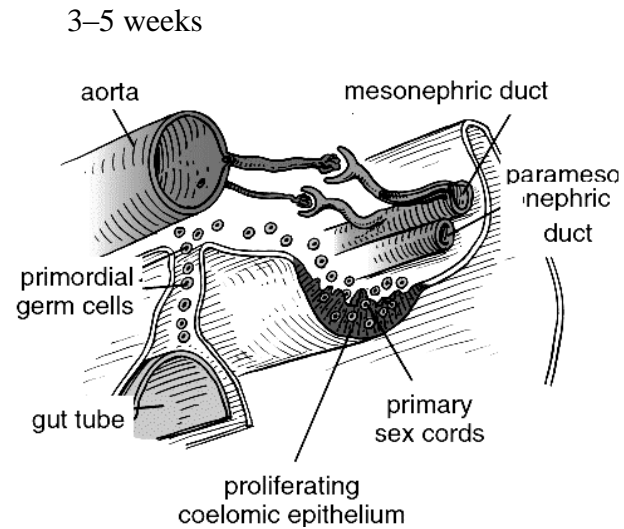
Structural basis of the hypophyseal, gonadotropic function.

EMBRIONIC SOURCES of MALE REPRODUCTIVE SYSTEM

Fill in the table at home

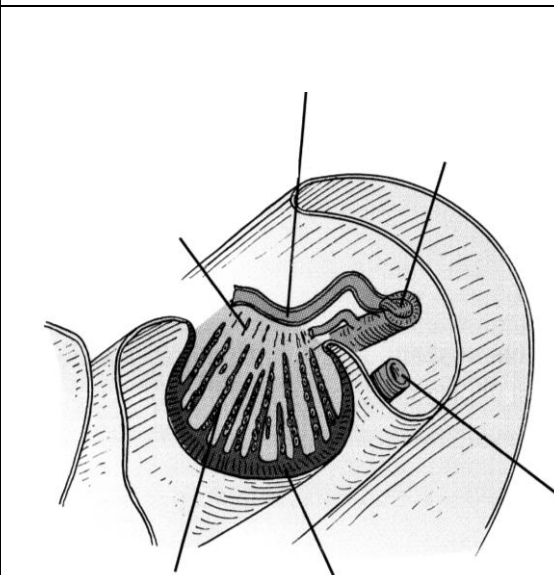
| Embryonic source | Structures of male reproductive system |
|--|---|
| Primary sex cords | 1. 2. 3. |
| Mesonephric tubule | 1. |
| Mesonephric ducts (Wolf's ducts) | 1. 2. 3. 4. appendix epididymus (rudiment) |
| Paramesonephric ducts (Mullerian duct) | 1. appendix testis (rudiment) |

Task 178. MIGRATION OF GONOCYTES (SCHEME)



A

Task 179. DEVELOPMENT OF INTERNAL MALE REPRODUCTIVE ORGANS



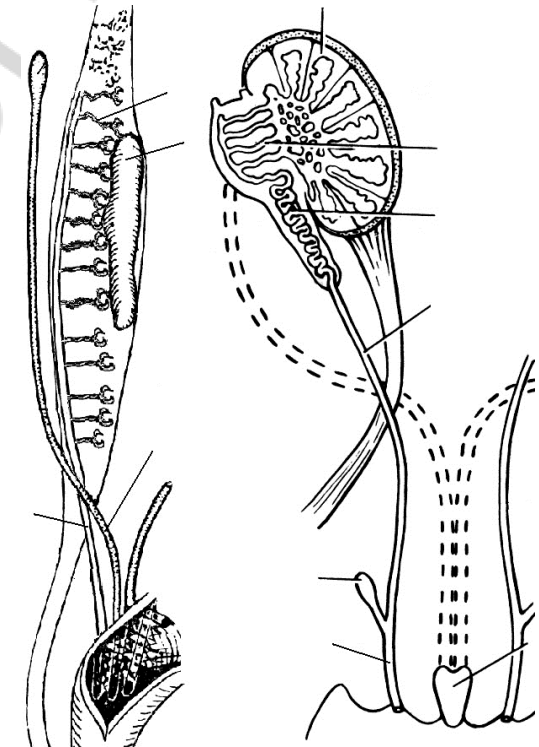
B

Designate:

- 1 — degenerating mesonephric tubule;
- 2 — mesonephric duct;
- 3 — developing rete testis;
- 4 — paramesonephric duct;
- 5 — seminiferous cord;
- 6 — tunica albuginea.

5-6 weeks

30 weeks

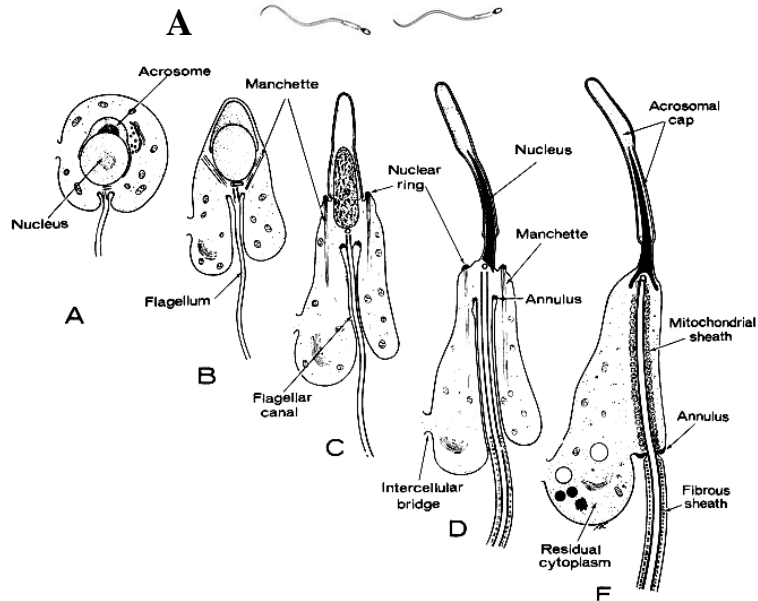
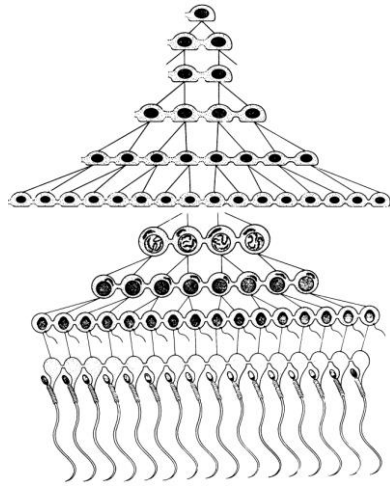


C

Designate:

- 1 — genital ridges; 2 — mesonephric tubules;
- 3 — mesonephric duct; 4 — paramesonephric duct;
- 5 — testis; 6 — efferent ductules; 7 — epididymis;
- 8 — ductus deferens; 9 — seminal vesicles;
- 10 — ejaculatory canal; 11 — prostatic utricle.

Task 180. SPERMATOGENESIS



B

Designate:

A.

I — proliferation stage (spermatogonial phase):

1 — spermatogonia type A dark;

2 — spermatogonia type A pale;

3 — spermatogonia type B.

II — growth stage:

4 — primary spermatocytes;

III — maturation stage:
5 — secondary spermatocytes;

6 — spermatids.

IV — formation stage (spermatid phase, spermiogenesis).

B.

Formation stage includes 4 phase:

A — Golgi phase;

B — cap phase;

C — acrosomal phase;

D, E — maturation phase.

Task 181. EFFERENT DUCTULES AND DUCTUS EPIDIDYMIS

Staining: Hematoxylin-eosin

Magnification: 400×

Draw and designate:

I — ductuli efferentes (in the cross-section):

1 — epithelial cells;

2 — fibrous muscular layer.

II — ductus epididymis (in the cross-section):

3 — epithelium;

4 — muscular elastic layer.

Task 182. TESTIS

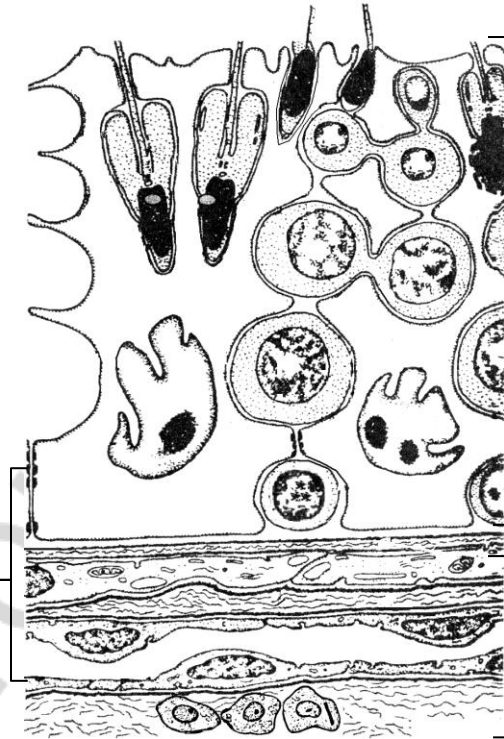
Staining: Hematoxylin-eosin

Magnification: 400×

Draw and designate:

- | | |
|--|---|
| 1 — mesothelium; | 7 — Sertoli's supporting cells (sustentocytes); |
| 2 — albuginous membrane; | 8 — spermatogonia; |
| 3 — connective tissue between tubules; | 9 — primary and secondary spermatocytes; |
| 4 — Leydig's interstitial cells; | 10 — spermatids; |
| 5 — blood capillaries; | 11 — spermatozoa at the stage of formation; |
| 6 — basal membrane; | 12 — mature spermatozoa. |

Task 183. STRUCTURE OF THE CONVOLUTED SEMINAL TUBULE WALL AND TESTIS INTERSTITIUM (scheme)



Color and designate:

I — spermatogenic epithelium:

- basal part — **in yellow**;
adluminal part — **in blue**;
1 — sustentocytes — **in green**;
2 — spermatogonia;
3 — primary spermatocytes;
4 — secondary spermatocytes;
5 — spermatids;
6 — spermatozoa.

II — interstitium:

- 7 — Leydig's interstitial cells (glandulocytes).

III — structures of hemato-testicular barrier:

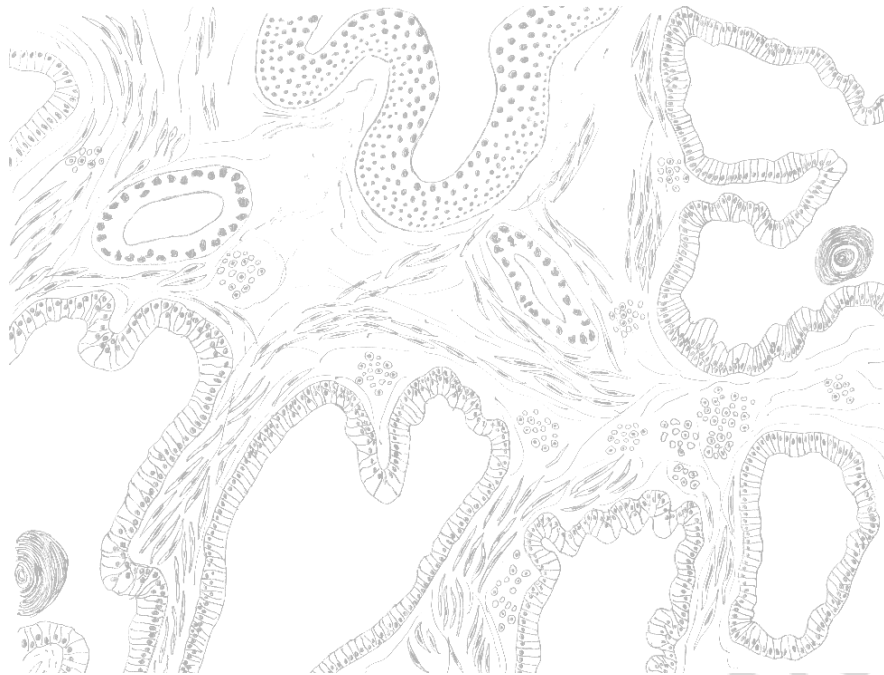
- basal membrane — **in orange**,
connective (fibrous) coat — **in violet**, myoid layer — **in red**;

- 8 — dense contacts between sustentocytic processes;
9 — basal membrane of spermatogenic epithelium;
10 — basal (internal fibrous) layer;
11 — internal basal membrane of myoid cells;
12 — myoid cells;
13 — external basal membrane of myoid cells;
14 — external fibrous coat;
15 — basal membrane of blood capillary;
16 — endotheliocyte of blood capillary.

Task 184. PROSTATIC GLAND

Staining: Hematoxylin-eosin

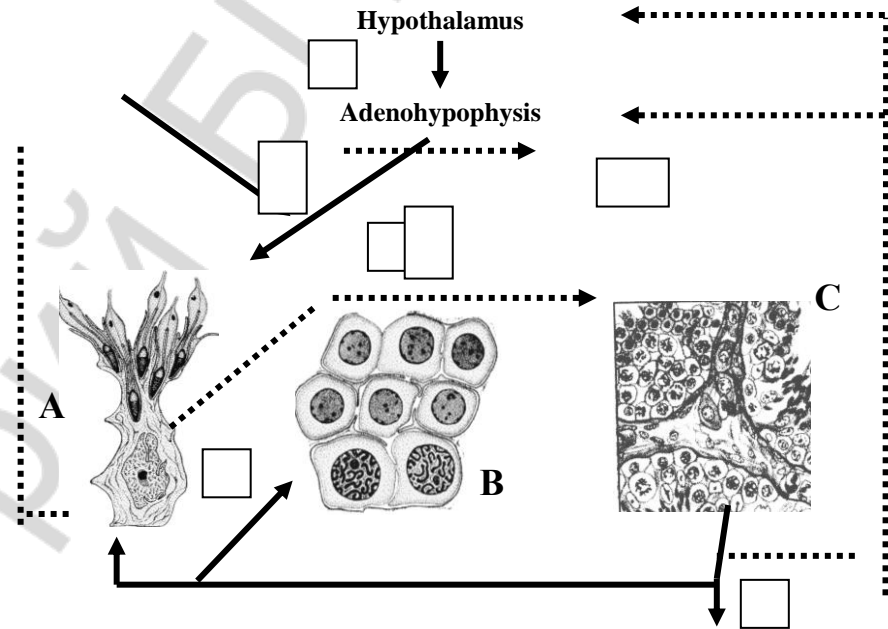
Magnification: 80×, 400×



Draw and designate:

- 1 — secretory portions of the gland;
- 2 — excretory ducts of the gland;
- 3 — bands of smooth muscular cells;
- 4 — connective tissue septa;
- 5 — blood vessels;
- 6 — prostatic concretions;
- 7 — transitional epithelium of the urethra.

Task 185. HORMONAL REGULATION OF MALE REPRODUCTIVE FUNCTION



- A — Sertoli cell; B — spermatocytes; 5 — Inhibin;
 C — Leydig cell. 6 — Estrogen;
 1 — Gonadoreleasing hormone; 7 — Testosterone.
 2 — FSH;
 3 — LH;
 4 — ABP;

Correct tasks № _____

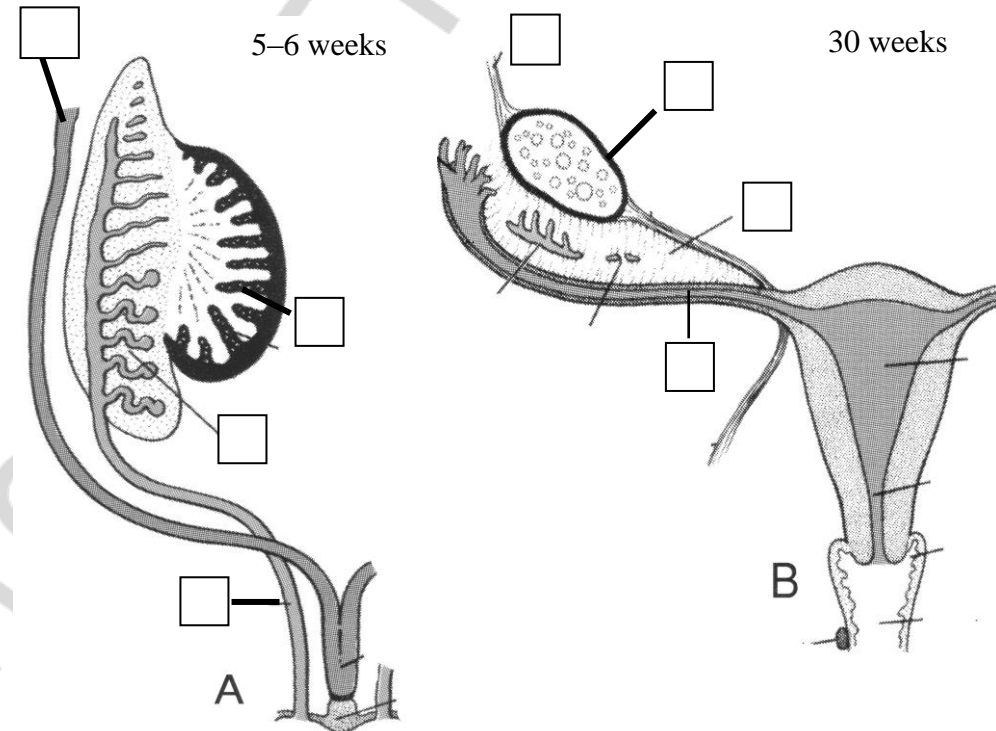
Lecturer _____

Topic 25. FEMALE REPRODUCTIVE SYSTEM

1. Structure of the ovary, embryonic sources of its development, age-related changes.
2. Oogenesis, its stages. Differences between oogenesis and spermatogenesis.
3. Ovarian follicles and their varieties.
4. Mature follicle. Ovulation.
5. Yellow body, its development, involution, functional value.
6. Follicular atresia. Structure of the atretic body.
7. Endocrine function of the ovaries.
8. Development and structure of the uterine tube.
9. Uterus, its structure, cyclic and age-related changes.
10. Ovario-menstrual cycle, its regulation.
11. Vagina, its structure, cyclic changes.

It is recommended to revise the notes of the lecture
"Female reproductive system".

Task 186. DEVELOPMENT OF FEMALE REPRODUCTIVE ORGANS



Designate:

A — Indifferent stage

- 1 — primary sex cord;
- 2 — mesonephrous tubule;
- 3 — paramesonephric duct;
- 4 — mesonephric duct;

B — Differentiated stage

- 5 — suspensory ligament of ovary;
- 6 — ovary;
- 7 — mesovarium;
- 8 — uterine tube.

Task 187. DEVELOPMENT OF FEMALE REPRODUCTIVE SYSTEM

FILL IN AT HOME

INDIFFERENTIATED STAGE

Call the structures of reproductive system:

- 1 –
- 2 –
- 3 –
- 4 –

DIFFERENTIATED STAGE

Primary sex cords with primordial germ cells form:

- 5 –
- 6 –

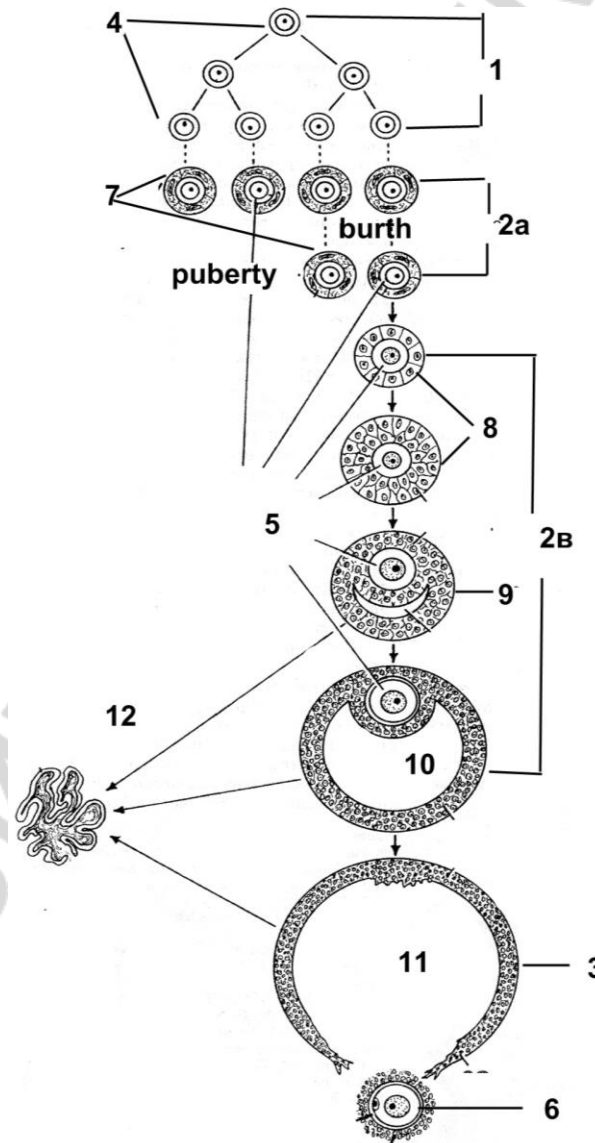
Paramesonephric duct forms:

- 7 –
- 8 –

Mesonephric duct forms:

- 9 –
- 10 –

Task 188. SCHEME OF OVOGENESIS AND FOLLICULOGENESIS



Designate:

Stage of oogenesis:

- 1 –
- 2a –
- 2b –
- 3 –

Name of germ cells:

- 4 –
- 5 –
- 6 –

Stage of follicles' development:

- 7 –
- 8 –
- 9 –
- 10 –
- 11 –
- 12 –

Task 189. OVARY

Staining: Hematoxylin-eosin

Magnification: 80×, 400×

Draw and designate:

I — ovarian membranes:

- 1 — rudimental epithelium;
- 2 — albugineous membrane.

II — primordial follicles:

- 3 — primary oocyte;
- 4 — flattened follicle cells.

III — growing (primary) follicle:

- 5 — primary oocyte;
- 6 — zona pellucida;
- 7 — granular layer.

IV — secondary follicle:

V — mature follicle:

- 8 — primary oocyte;
- 9 — zona pellucida
- 10 — cumulus oophorus;
- 11 — granulosa cells;
- 12 — corona radiata;
- 13 — antrum with follicular fluid;
- 14 — theca interna;
- 15 — theca externa.

V — atretic body;

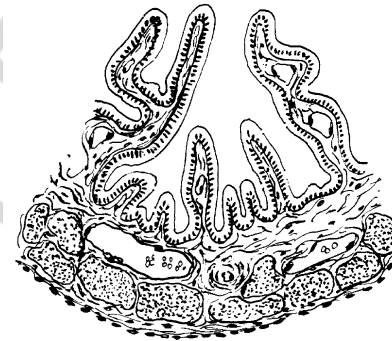
VI — yellow body:

- 16 — lutein cells;
- 17 — blood capillaries.

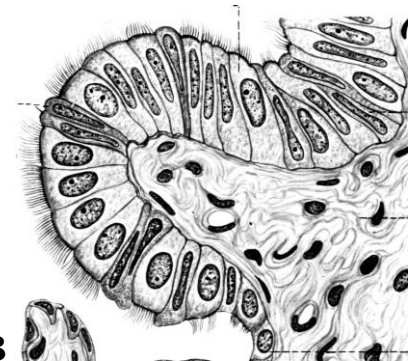
Task 190. UTERINE TUBE

Staining: Hematoxylin-eosin

Magnification: 80×



A



B

Designate in fig. A:

I — mucous membrane: 1 — columnar ciliated epithelium; 2 — lamina propria of the mucous membrane.

II — muscular layer:

3 — circular membrane; 4 — longitudinal membrane.

III — serous coat

B — columnar epithelium:

5 — ciliated cells; 6 — nonciliated cells.

Task 191. UTERUS OF THE CAT

Staining: Hematoxylin-eosin

Magnification: 80×, 400×

Draw and designate:

I — endometrium:

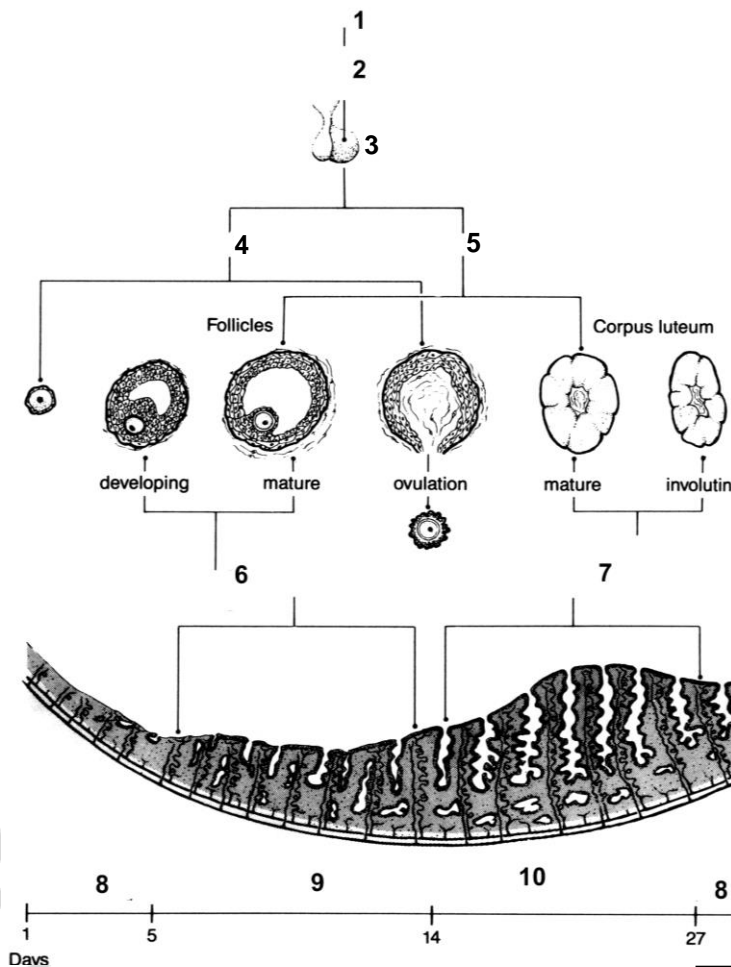
- 1 — columnar epithelium;
- 2 — lamina proper of the mucous membrane;
- 3 — uterine gland.

II — myometrium:

- 4 — submucous layer;
- 5 — vascular layer;
- 6 — supravascular layer;
- 7 — blood vessels.

III — perimetrium.

Task 192. OVARIO-MENSTRUAL CYCLE



Write organs and hormones:

1 – Hypothalamus

2 –

3 –

4 –

5 –

6 –

7 –

Name the phase of menstrual cycle

8 –

9 –

10 –

Correct tasks № _____

Lecturer _____

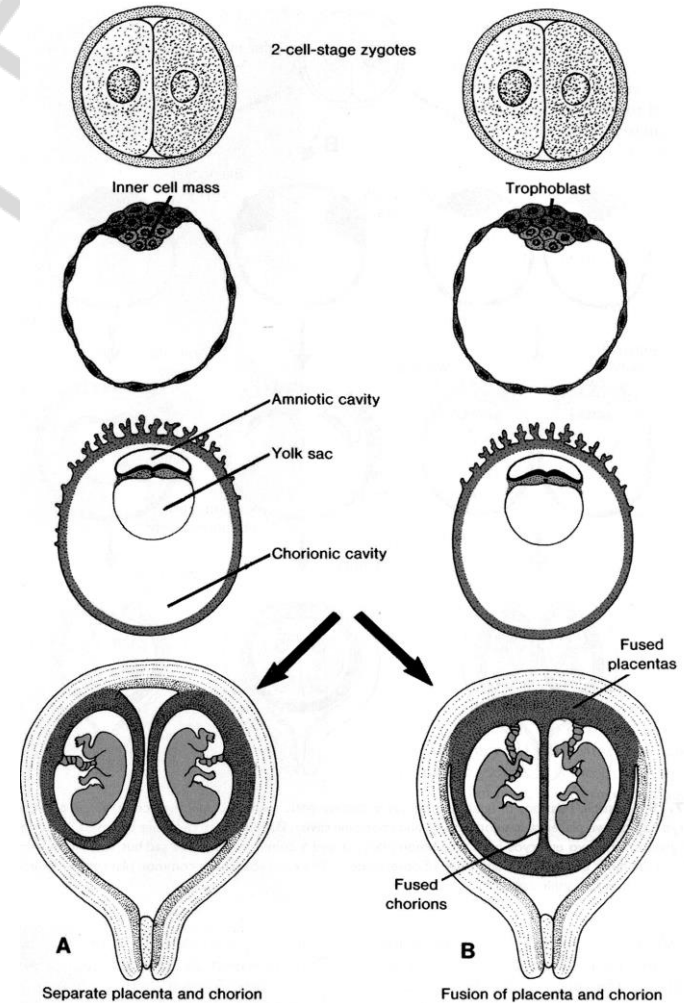
Topic 26. 3–4 WEEKS OF HUMAN EMBRYOGENESIS. ORGANO- AND HISTOGENESIS. CRITICAL PERIODS OF DEVELOPMENT

1. Embryos at the end of the 3rd week. The early stages of development of nervous and cardio-vascular system.
2. Organo- and histogenesis. Definition. The components of embryonic development.
3. Embryos structure on the 4th week. Primordial formation and development of the main system organs on the 4–8 weeks of embryogenesis.
4. Critical periods of development. The role of exo- and endogenic factors in the occurrence of anomalies and malformations. Atypical histogenesis and its forms.

Revise:

- Fertilization
- Cleavage
- Gastrulation
- Differentiation of germ layers.

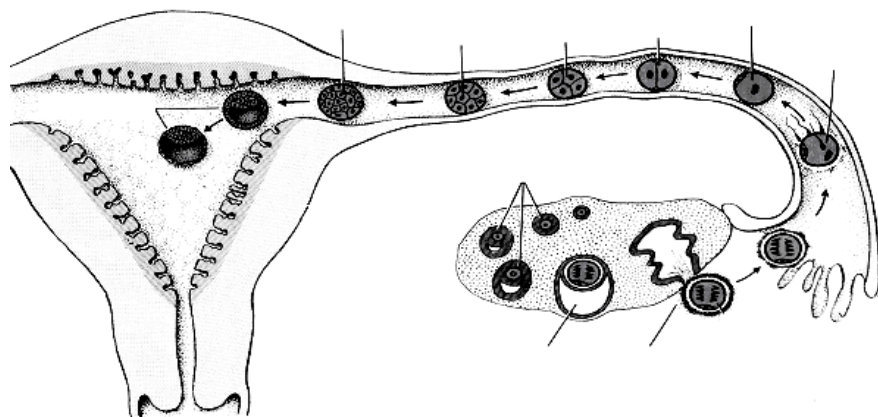
Development of dizygotic twins



Task 193. SCHEME OF CONCEPTUS MIGRATION
(the first week).

Designate:

1 — immature follicles; 2 — tertiary follicle; 3 — oocyte; 4 — fertilization; 5 — zygote; 6 — two-cell stage (30 hours); 7 — four-cell stage (40–50 hours); 8 — eight-cell stage (60 hours); 9 — morula; 10 — blastocyst.



Task 194. PERIODS OF HUMAN EMBRYOGENESIS
AND PHASES OF MENSTRUAL CYCLE

| Period of embryogenesis | Organism | Time of embryonic development | Days of menstrual cycle |
|---------------------------------|-----------|-------------------------------|--|
| Fertilization | Conceptus | 1st day | 14–15 |
| Cleavage | | 2–5th day | 16–19 (beginning of the secretory phase) |
| Gastrulation early | | 6–13rd day | 20–27 (middle of the secretory phase, corpus luteum secretes, implantation) |
| late | Embryo | 14–21st day | 28–35 (beginning of placentation, absent menstrual flow) |
| Organo- and histogenesis | | 4–9th week | ≥ 36 (following development of the placenta) |
| | Fetus | 10–40th week | |

Task 195. LATERAL AND AMNIOTIC FOLDS OF CHICKEN'S EMBRYO

Staining: Hematoxylin

Magnification: 80×, 400×

Designate:

- | | |
|---|------------------------|
| 1 — ectoderm; | 7 — endoderm; |
| 2 — neural tube; | 8 — forming intestine; |
| 3 — notochord; | 9 — blood vessels; |
| 4 — somite; | 10 — amniotic fold; |
| 5 — nephrotome; | 11 — lateral fold. |
| 6 — layers of mesoderm (splanchnotome); | |

The definition of the concept “CRITICAL PERIODS OF DEVELOPMENT”: _____

A

Task 196. CRITICAL PERIODS OF DEVELOPMENT (CPD) IN ONTOGENESIS

- A — write down the definition of CPD;
 B — enumerate CPD of the human ontogenesis;
 C — study the classification of development anomalies; compare the anomaly groups with the basic processes of embryogenesis.

The reasons of the critical periods:

1. Activation of genetic information (determination of the development).
2. Changes of trophic types.
3. Changes of regulating mechanisms in the course of development.

Enumerate the critical periods of the human ontogenesis:

B

CLASSIFICATION OF DEVELOPMENT ANOMALIES (according to A. G. Knorre)

C

| Types of anomalies | The character of the developmental changes |
|--|--|
| caused by cellular reproduction disturbance; | growth impairment of separate rudiments; |
| caused by impairment of cell and cellular complexes migration; | changes of organ and tissue spatial interrelation; |
| caused by unusual directions of cell and tissue differentiation; | formation of abnormal cell and tissue structures or atypical correlation of normal structures; |
| caused by disruption of correlative connections between cellular complexes, rudiments of organs and tissues; | |
| caused by changing processes of physiological cell death; | fall out of “reverse development” of germ provisory structures; |
| caused by metabolic disturbances. | without marked morphological defects. |

**Stage of histo-
and organogenesis**

ORGANOGEN

HISTOGENESI

The first phase:
NEURULATION

The second phase:
**ORGANS
AND SYSTEMS
FORMATION**

Development
of epithelial,
connective,

| The term of primordial formation | The organ, system |
|----------------------------------|-----------------------------------|
| 2–3rd week | epidermis |
| 3rd week | cardiovascular system |
| 3–4th week | nervous system thyroid gland |
| 4th week | digestive system sense organs |
| 4–5th week | hemopoietic organs hypophysis |
| 5th week | respiratory system urinary system |
| 5–6th week | adrenal glands, epiphysis |
| 7–8th week | reproductive system |

Task 197. THE BASIC EPIGENETIC MECHANISMS OF EMBRYONIC DEVELOPMENT REGULATION

OOPLASMATIC

METABOLIC GRADIENTS

INTERCELLULAR

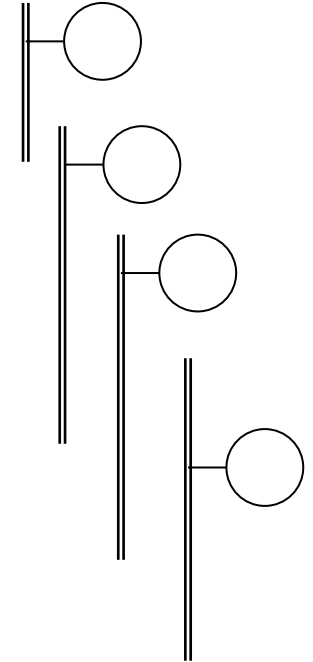
CRITICAL MASS OF CELLS

EMBRYONIC INDUCTION

BIOMECHANICAL

INTERSTITIAL

NEURO-ENDOCRINE



Write down the stages of embryogenesis, which correspond to regulation mechanisms into the circles as shown in the scheme:

- 1 — fertilization;
- 2 — cleavage;
- 3 — gastrulation;
- 4 — histo- and organogenesis.

Correct tasks № _____

Lecturer _____

Topic 27. HUMAN EMBRYONIC DEVELOPMENT: EXTRAEMBRYONIC ORGANS

1. Fertilization, its phases, conditions necessary for fertilization.
2. Cleavage. Influence of external and internal factors on the process of cleavage. Blastocyst structure.
3. Differentiation of the trophoblast. Implantation. Changes in the structure of uterus mucosa during pregnancy.
4. Differentiation of the embryoblast. Formation and functions of the amnion, yolk sac, allantois.
5. Chorion. Structure of chorionic villi. Development and structure of fetal membranes.
6. Placenta. Structure and functions. Hormonal regulation of pregnancy (mother's organism and placenta). Topography of the fetus and its membranes in the uterus during pregnancy.
7. Mammary gland, sources of development, structure, function. Morphological differences between lactational and unlactational mammary gland.
8. Critical periods of development. The role of exo- and endogenic factors in the occurrence of abnormalities and malformations. Atypical histogenesis and its forms.

The stages of embryonic development:

- 1.
- 2.
- 3.
- 4.

Define:

1) The type of human oocyte _____

2) Cleavage _____

3) The type of blastula _____

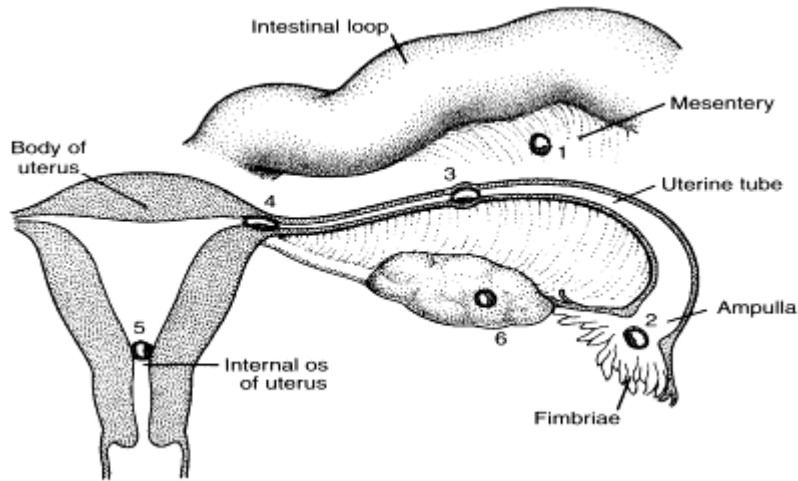
4) Gastrulation _____

5) Extraembryonic organs _____

Task 198. ABNORMAL IMPLANTATION SITES OF THE BLASTOCYST

Write down the possible sites of abnormal implantation:

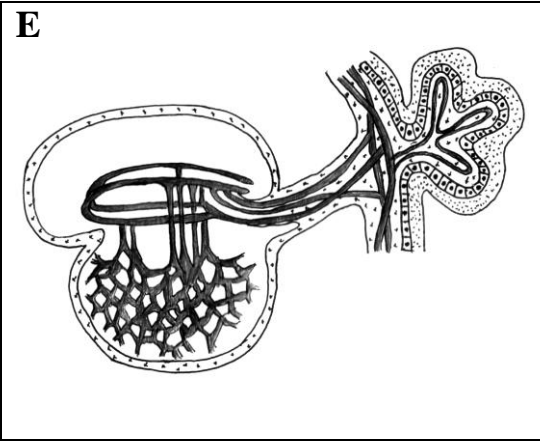
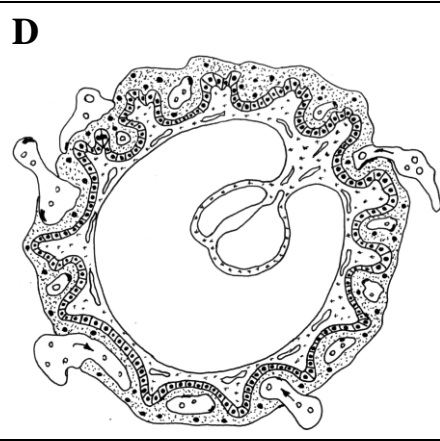
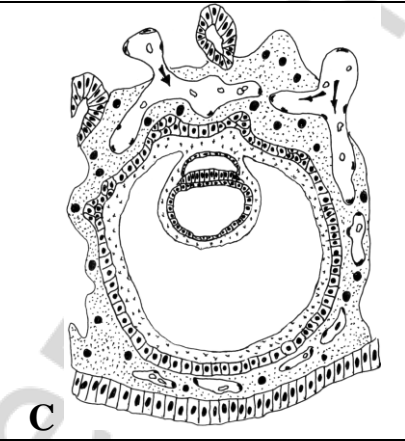
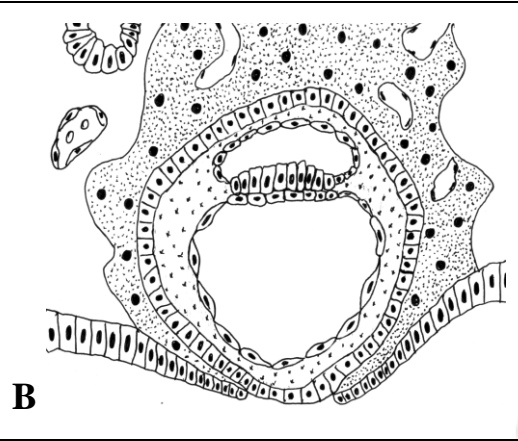
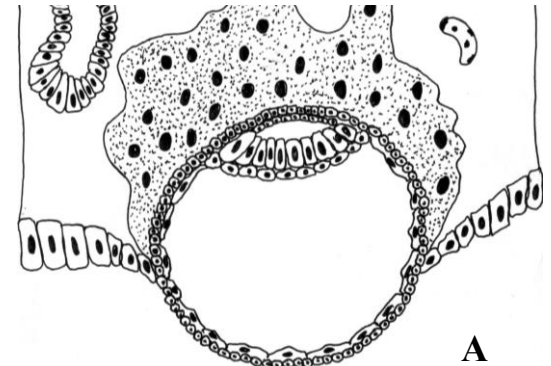
- | | |
|----|----|
| 1. | 4. |
| 2. | 5. |
| 3. | 6. |

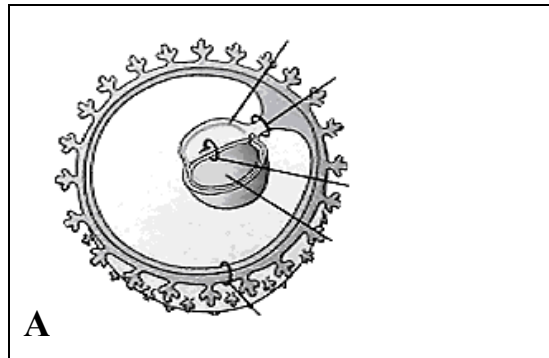


Task 199. SCHEME OF EXTRAEMBRYONIC ORGANS FORMATION

A — beginning of implantation, 6th day; B — end of implantation, 7–8th days; C — 13th day; D — 16th day; E — beginning of placental blood flow, 20th day.

- 1 — embryonic disk;
- 1a — epiblast; 1b — hypoblast;
- 2 — amniotic sac;
- 3 — yolk sac;
- 4 — cytotrophoblast;
- 5 — syncytiotrophoblast;
- 6 — uterine blood vessel;
- 7 — uterine glands;
- 8 — extraembryonic mesoderm;
- 9 — chorionic wall;
- 10 — chorionic villi;
- 11 — allantois;
- 12 — amniotic stalk;
- 13 — blood vessels of chorionic villi;
- 14 — umbilical blood vessels.





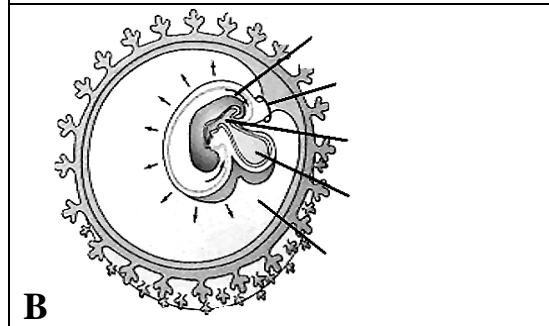
A

Task 200. SCHEME OF EXTRAEMBRYONIC ORGANS INTERPOSITION

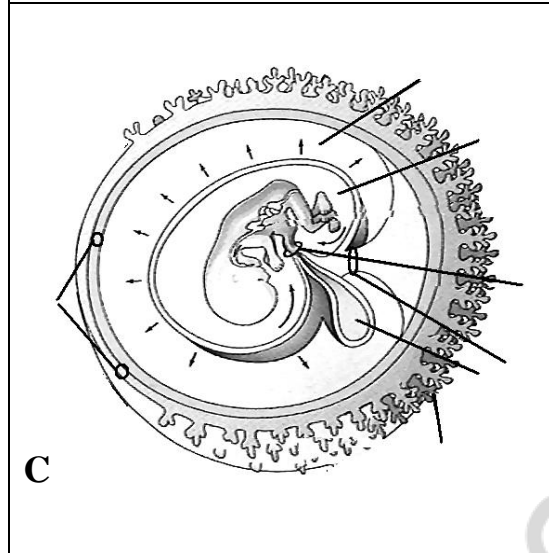
A — 3^d week; B — 4th week; C — 10th week; D — 20th week.

Designate:

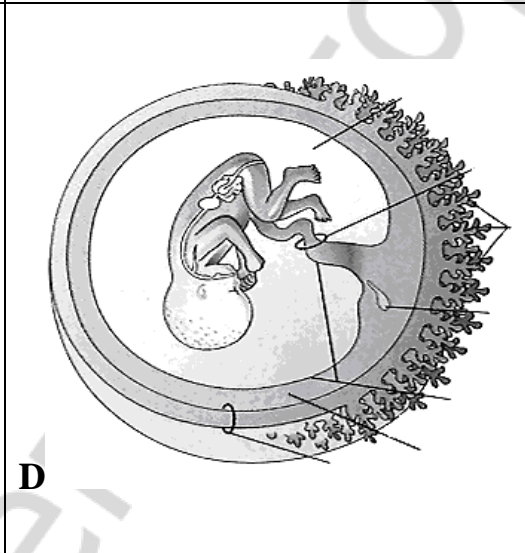
- 1 — embryonic disc;
- 2 — amnion;
- 2a — amniotic epithelium (on fig. D)
- 3 — yolk sac;
- 4 — amniotic stalk;
- 5 — chorionic wall: 5a — chorion frondosum; 5b — chorion laeve;
- 6 — chorionic cavity;
- 7 — chorionic plate;
- 8 — umbilical cord.



B

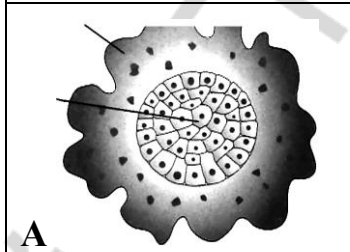


C

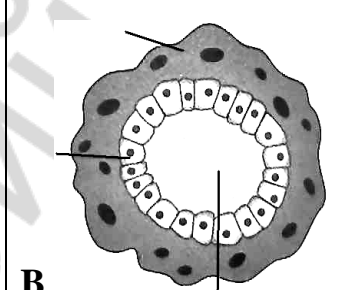


D

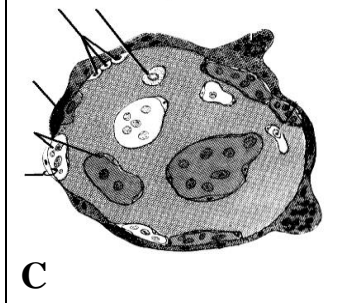
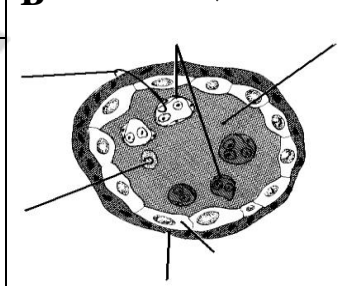
Task 201. SCHEME OF CHORIONIC VILLUS STRUCTURE



A



B



C

Designate:

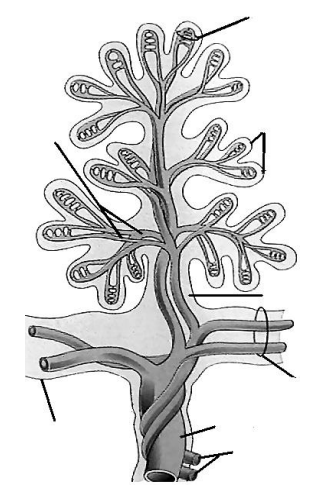
A — primary villus; B — secondary villus; C — tertiary villus during the Ist and IInd half of pregnancy.

1 — cytotrophoblast; 2 — syncytiotrophoblast; 3 — mesenchyme; 4 — capillaries of villi; 5 — Kaschenko-Hofbauer's cells; 6 — placental barrier.

D — main stem villus.

1 — umbilical vein; 2 — umbilical arteries; 3 — amniotic wall; 4 — chorionic plate; 5 — mesenchyme of the villus; 6 — blood vessels of the villus; 7 — terminal branching; 8 — capillaries of the villus.

D



Task 202. HUMAN PLACENTA (fetal and maternal parts)

Staining: Hematoxylin-eosin

Magnification: 80×, 400×

Draw a picture on the basis of two slides.

Mark:

- 1 — amniotic epithelium;
- 2 — chorionic plate;
- 3 — trophoblastic villi epithelium (cytotrophoblast and syncytiotrophoblast);
- 4 — villus connective tissue;
- 5 — villus blood vessels;
- 6 — fibrinoid;
- 7 — lacunas with maternal blood;
- 8 — basal layer;
- 9 — decidual cells.

Task 203. MAMMARY GLAND

Staining: Hematoxylin-eosin

Magnification: 80×

Draw and designate:

I — glandular lobe (acinus):

- 1 — secretory parts (alveoli);
- 2 — lactocyte;
- 3 — myoepitheliocyte;

II — interlobular septum:

- 4 — interlobular connective tissue;
- 5 — interlobular lacteal duct;
- 6 — blood vessels.

Correct tasks № _____

Lecturer _____

LIST OF CONTROL HISTOLOGICAL PREPARATIONS

Spring term

2-nd intermediate control

1. Мезенхима зародыша курицы. **Mesenchyme in embryonal section**
2. Рыхлая соединительная ткань. **Loose connective tissue**
3. Жировая ткань сальника кошки. **White adipose tissue**
4. Сухожилие теленка в продольном разрезе. **Dense regular connective tissue of the tendon**
5. Гиалиновый хрящ ребра кролика. **Hyaline cartilage**
6. Эластический хрящ ушной раковины свиньи. **Elastic cartilage**
7. Развитие кости на месте хряща. **Endochondral ossification**
8. Развитие кости из соединительной ткани. **Intramembranous ossification**
9. Берцовая кость человека в поперечном разрезе. **Cross section of compact substance of long bone**
10. Волокнистый хрящ. Межпозвоночный диск теленка. **Fibrocartilage**
11. Гладкая мышечная ткань в поперечном и продольном разрезе. **Smooth muscle tissue of urinary bladder**
12. Поперечно-полосатая мышечная ткань языка. **Skeletal muscle tissue of the tongue**
13. Миокард. Сердце лошади. **Cardiac muscle tissue**
14. Тигроид в нервных клетках спинного мозга. **Basophilic substance of the spinal cord's neurons**
15. Безмякотные нервные волокна. **Unmyelinated nerve fibers**
16. Мякотные нервные волокна. **Myelinated nerve fibers**
17. Артериолы, вены, капилляры. **Arterioles, venules, capillaries**
18. Артерия мышечного типа. **Muscular artery**
19. Артерия эластического типа. Аорта. **Elastic artery**
20. Бедренная вена. **Vein (femoral vein)**
21. Волокна Пуркинье. Сердце быка. **Cardiac wall**
22. Трахея собаки. **Trachea**
23. Легкое кошки. **Lung**
24. Кожа пальца человека. **Finger skin**

Autumn semester

3-rd intermediate control

1. Развитие зуба, эмалевый орган. **Tooth development. Enamel organ.**
2. Развитие зуба. Образование дентина, эмали. **Tooth development. Late stage**
3. Листовидные сосочки языка. **The tongue of rabbit. Foliate papillae**
4. Поперечный разрез пищевода. **Cross section of the esophagus.**
5. Переход пищевода в желудок собаки. Дно желудка. **Fundus of the stomach**
6. Пилорическая часть желудка. **Pyloric portion of the stomach**
7. Тонкая кишка щенка. **Jejunum**
8. Толстая кишка собаки. **Large intestine**
9. 12-перстная кишка **Duodenum**
10. Печень свиньи. **Liver of the pig**
11. Печень человека **Human liver**
12. Поджелудочная железа. **Pancreas**
13. Подчелюстная железа **Submandibular gland**
14. Околоушная железа. **Parotid gland**
15. Красный костный мозг. **Red bone marrow**
16. Селезенка кошки. **Spleen**
17. Зобная железа. Тимус. **Thymus**
18. Небная миндалина. **Palatine tonsil**
19. Лимфатический узел. **Lymph node**
20. Паращитовидная железа. **Parathyroid gland**
21. Щитовидная железа. **Thyroid gland**
22. Гипофиз. **Hypophysis**
23. Надпочечник. **Adrenal gland**

25. Кожа с волосом. **Skin and its appendage**
4-th intermediate control

1. Спинальный ганглий. **Spinal ganglion**
2. Спинной мозг. **Spinal cord**
3. Поперечный срез седалищного нерва. **Cross-section of peripheral nerve**
4. Кора полушарий собаки. **Cerebral cortex**
5. Мозжечок. **Cerebellum. Transverse section**
6. Задняя стенка глаза собаки. **Posterior wall of the eye**
7. Многослойный плоский неороговевающий эпителий роговицы. **Cornea**
8. Кортиев орган. **Spiral organ**
9. Мочевой пузырь. **Urinary bladder**
10. Мочеточник. **Ureter**
11. Почки. **Kidney**
12. Простата. **Prostatic gland**
13. Придаток семенника. **Efferent ductuli and ductus epididymis**
14. Семенник. **Testis**
15. Матка. **Uterus**
16. Яичник. **Ovary**
17. Желтое тело яичника. **Corpus luteum**
18. Плацента человека. Материнская часть. **Human placenta. Maternal part of placenta**
19. Плацента человека. Плодная часть. **Human placenta. Fetal part of placenta**
20. Молочная железа. **Mammary gland**
21. Туловищная и амниотическая складки зародыша курицы. **Amniotic and lateral folds of chicken's embryo**

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