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ÜMUMİ HİSTOLOGİYA

Sxemlər

**Azərbaycan Tibb Universitetinin Elmi Şurasının 30
oktyabr 2018-ci il tarixli iclasında dərş vəsaiti kimi
dərş olunması qərara alınmışdır**

Bakı 2019

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Dərs vəsaiti tibb ixtisası üzrə təhsil alan ali və orta ixtisas məktəblərinin tələbələri üçün nəzərdə tutulmuşdur. Bununla birlikdə biologiya fakültəsinin tələbələri, həmçinin sitoloqlar, embrioloqlar və histoloqlar da istifadə edə bilərlər.

ÖN SÖZ

Son illər respublikamızın təhsil sistemində aparılan islahatlar, xüsusilə Avropa vahid təhsil ailəsinə inteqrasiya yönündə atılan ciddi addımlar bizim də qarşımızda vacib öhdəliklər qoyur. Əsas tibb fənlərindən biri olan histologiyanın tədrisini günün tələbləri səviyyəsində qurmaq üçün klassik məlumatlarla yanaşı, müasir elmi biliklərin toplanması və tələbələrə çatdırılması çox zəruridir.

Bu baxımdan tərtib edilmiş «Ümumi histologiya – sxemlər» adlı dərs vəsaiti sitologiya, ümumi embriologiya və ümumi histologiya fənlərinin daha dərinə və mükəmməl mənimsənilməsində tələbələrə yardımçı olmalıdır. Tələbələr sxemlərdəki strukturları dərs vəsaitinin elektron variantına müvafiq olaraq rəngləməli və onların adlarını sol tərəfdə ayrılmış boş yerdə yazmalıdırlar. Dərs vəsaitinə daxil edilmiş sxemlərin böyük əksəriyyəti tədris proqramında nəzərdə tutulmuş preparatlara uyğun çəkilmişdir. Ona görə də tələbələr dərs prosesi zamanı öyrənilən histoloji mikropreparatlarla bilavasitə mikroskopun müxtəlif böyüdücülərində baxmaqla yanaşı, onların sxemlərinin miqyasının kompüterdə artırır - azalma imkanlarına da malik olacaqlar. Bu işə keçirilən materialın tələbələr tərəfindən mənimsənilməsini xeyli asanlaşdırmalıdır.

Müəllif sxemlərin tərtibində istifadə olunmuş ədəbiyyat materiallarının (adları ədəbiyyat siyahısında verilmişdir) və ələl xüsüs “Vikipediya” saytlarında istifadəsinə icazə verilmiş materialların müəlliflərinə, kafedra əməkdaşlarından ass. N.T. Quliyevaya və A.Ə. Əliyərbəyovaya öz dərin minnətdarlığını bildirir.

Dərs vəsaitinin tərtibində buraxılmış xətalara görə əvvəlcədən üzr istəyir və bu haqda məlumat verənlərə öz minnətdarlığımı bildirirəm.

Müəllif

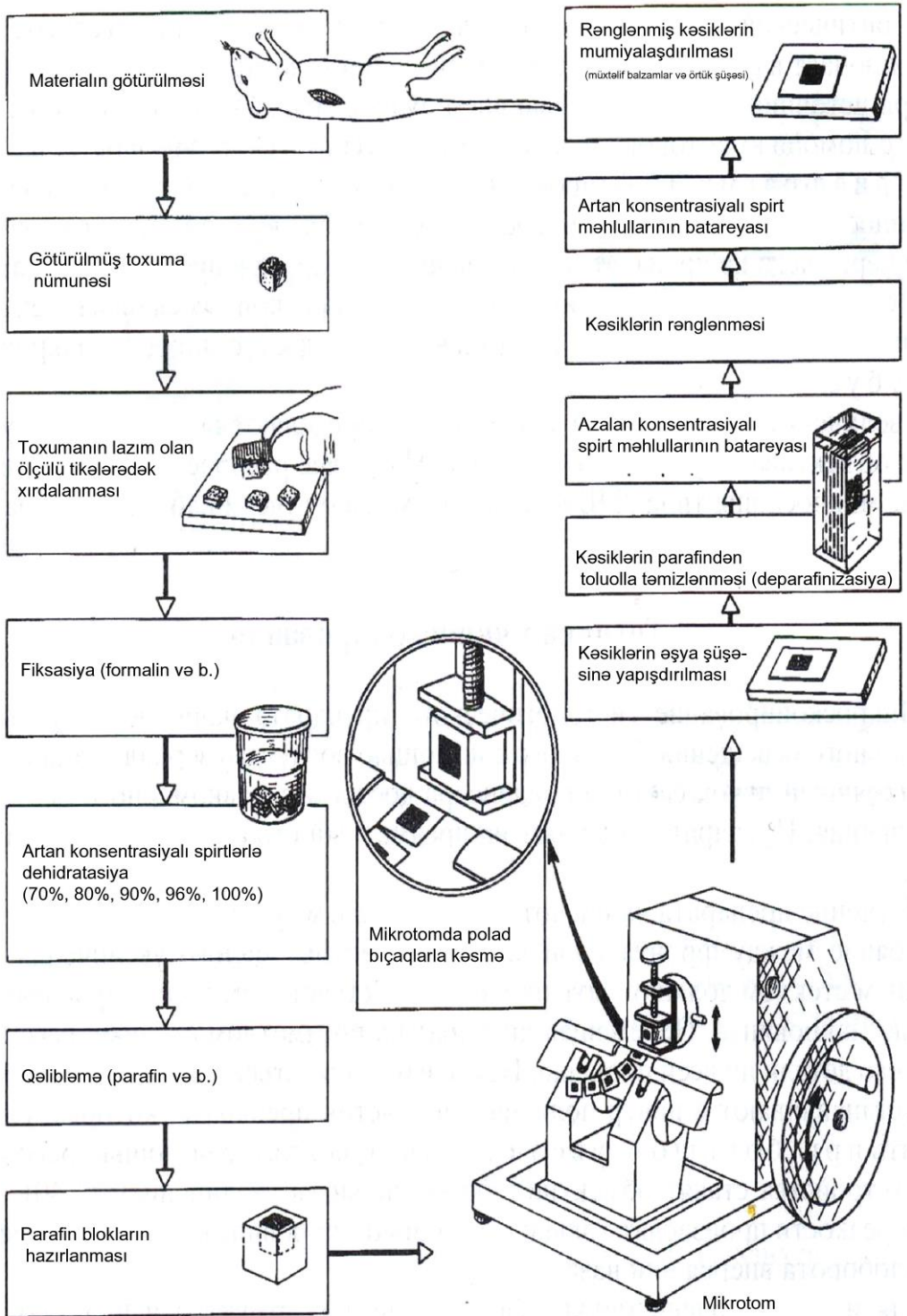
MÜNDƏRİCAT

ÖN SÖZ

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Histoloji texnika. Eukariot hüceyrələrin ümumi morfologiyası. Hüceyrə zarının kimyəvi tərkibi və ultrastrukturu.

1

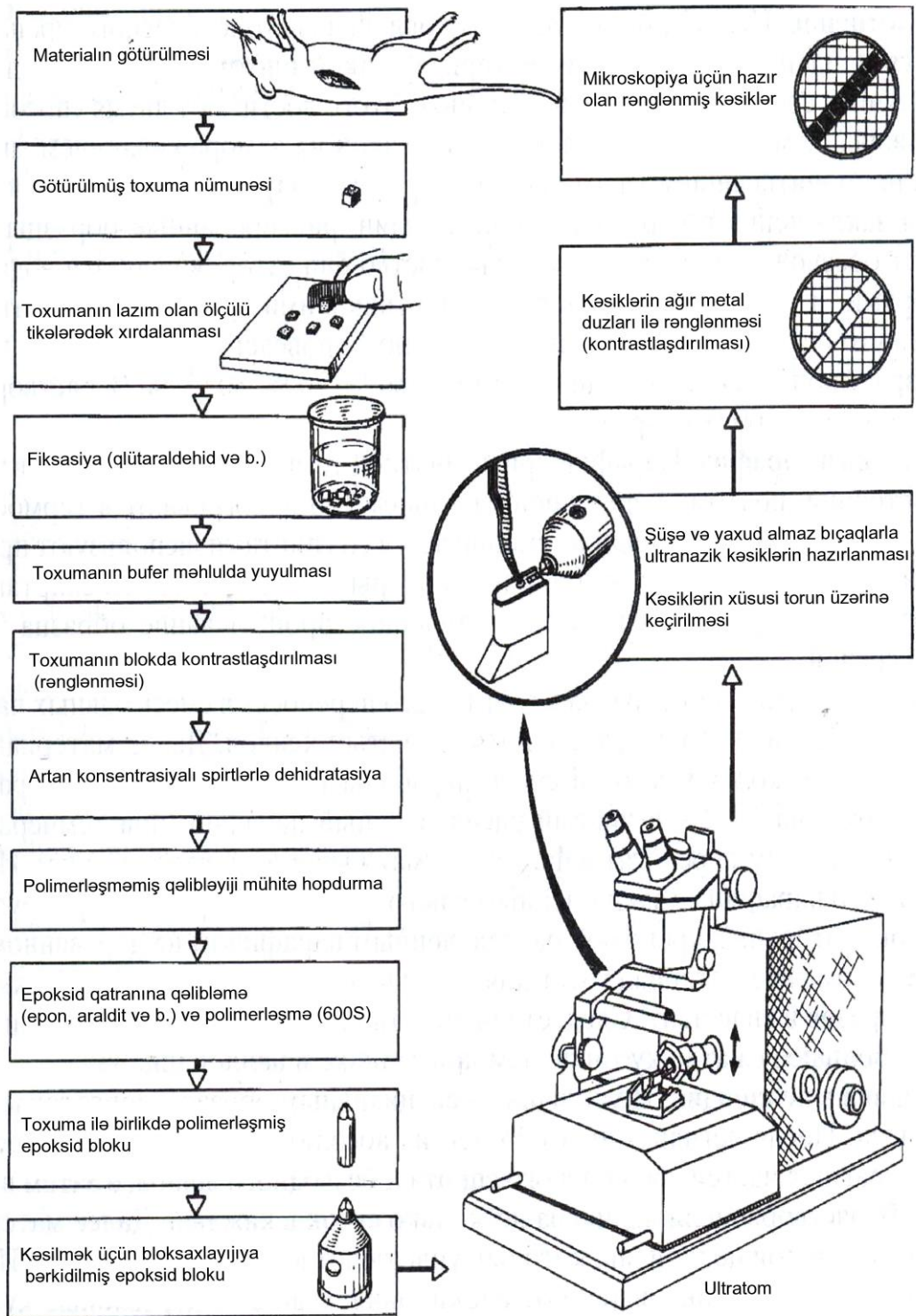


Şəkil 1.1.

Рисунок 1.1.

Figure 1.1.

- 1. taking of material**
- 2. taken tissue specimen**
- 3. to cut into small pieces as required (1cm³)**
- 4. fixation (formalin) and washing**
- 5. Dehydration with increasing concentration of alcohol (70%, 80%, 90%, 96%, 100%)**
- 6. embedding (paraffin)**
- 7. preparation of histological blocks**
- 8. cutting in microtome with steel knife**
- 9. microtome**
- 10. glue of sections to glass**
- 11. deparaffinization**
- 12. series with decreasing concentration of alcohol**
- 13. staining of sections**
- 14. series with increasing concentration of alcohol**
- 15. Cover of sections with covering glass.**



Şəkil 1.2.

Рисунок 1.2.

Figure 1.2.

Fig. 1.2. Stages of semithin and ultrathin sections preparation for electron microscope.

1. taking of material
2. taken tissue specimen
3. to cut into small pieces as required (1 mm)
4. fixation (glutaraldehyde)
5. washing of specimen in buffer solutions
6. staining of specimen in block with osmium acid
7. dehydration with increasing concentration of alcohol (70%, 80%, 90%, 96%, 100%)
8. absorption to unpolymerized embedding milieu
9. embedding (epon-araldite) and polymerization
10. preparation of epon-araldite block
11. epon-araldite block with block-keeper
12. ultramicrotome
13. collection of sections on a cooper grid
14. cutting in ultramicrotome with glass or diamond knife
15. thin-section staining with heavy metal salts (uranyl acetate, lead citrate)
16. ultrathin sections ready for electron microscopy.

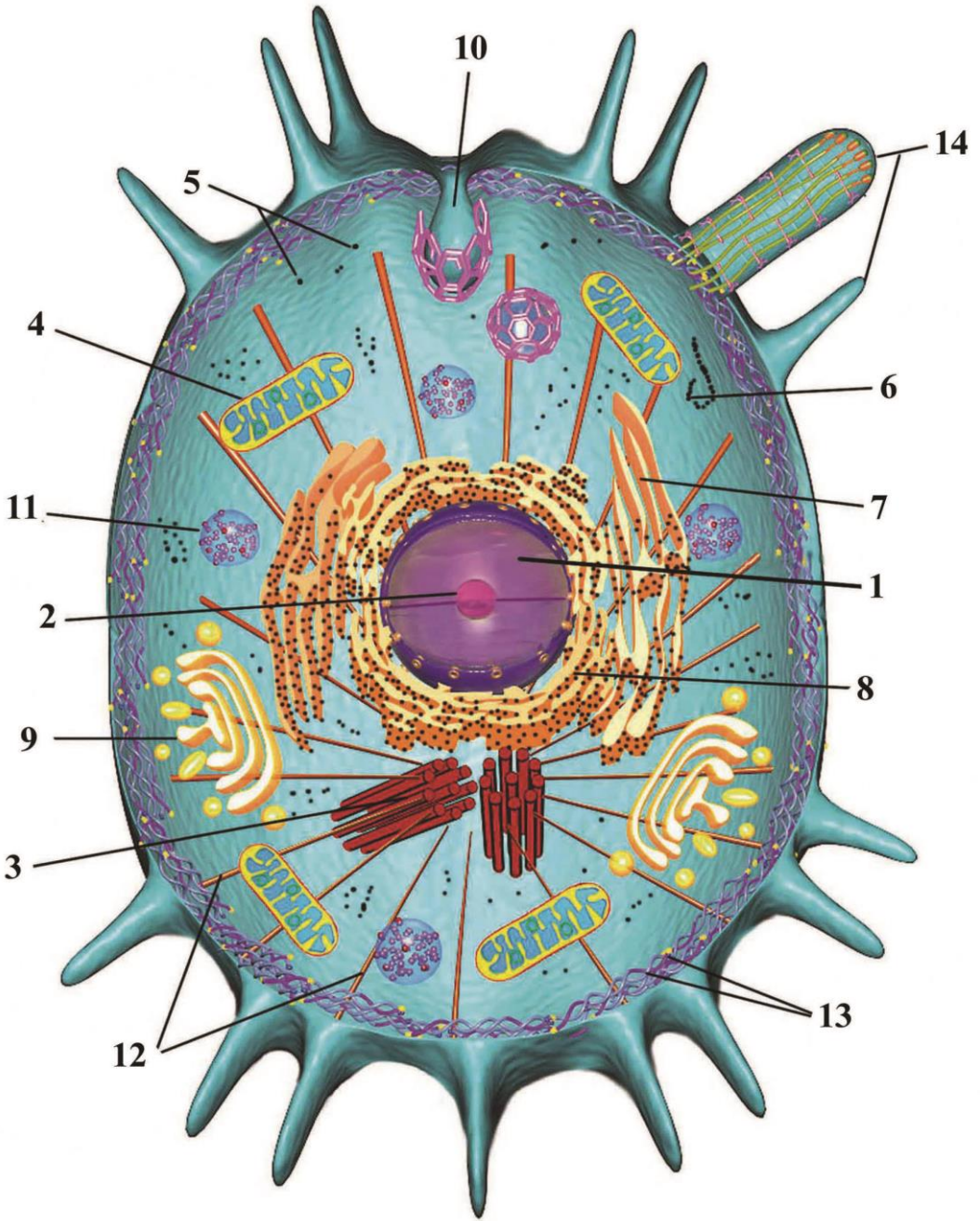
**STAGES OF HISTOLOGIC SECTIONS STAINING
WITH HEMATOXYLIN AND EOSIN:**

N	STAGE	REAGENT	TIME	NOTE
1.	Deparaffinization (cleaning of paraffin from section)	Toluol 1 Toluol 2 Toluol and ethanol Alcohol 96 ⁰ Alcohol 70 ⁰ Distilled water	5 min 5 min 2 min 2 min 5 min	
2.	Staining with hematoxylin	Solution of hematoxylin	15-20 min	Control by microscope
3	Washing	Distilled water		
4.	Staining with eosin	Solution of eosin		
5.	Washing	Distilled water		Untill to washing of additional eosin
6.	Dehydratation	Ethanol 70 ⁰ Ethanol 80 ⁰ Ethanol 96 ⁰	1-2 min 1-2 min 1-2 min	
7.	To elucidate of sections	Toluol	2-3 min	
8.	Covering of colored sections	Cover glass, balzam		
9.	Draining of sections	Thermostat (37 ⁰ C)		

Şəkil 1.3.

Рисунок 1.3.

Figure 1.3.



Şəkil 1.4.

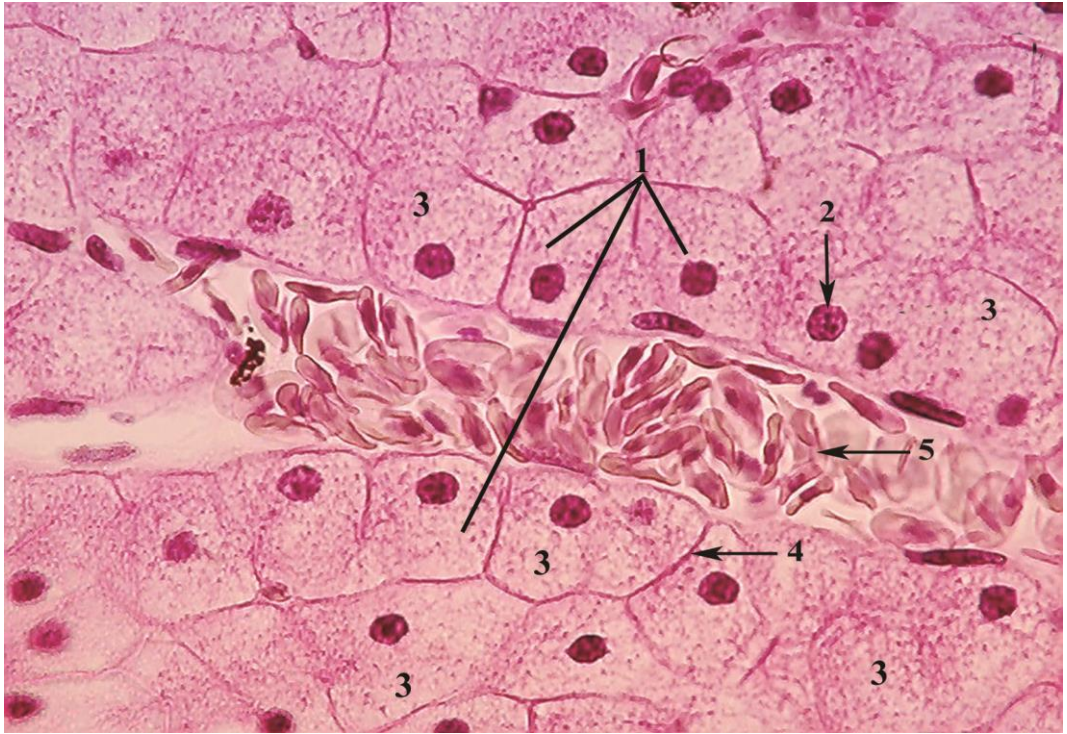
Рисунок 1.4.

Figure 1.4.

Schematic representation of structural elements of somatic cell.

1.nucleus 2.nucleolus 3.centriol 4.mitochondrion 5.free ribosomes
6.polyribosome 7.smooth endoplasmic reticulum 8.rough endoplasmic

reticulum 9.Golgi complex 10.receptor-gated endocytosis 11.lysosome
12.microtubules 13.cortical cytoplasm 14.microvilli.



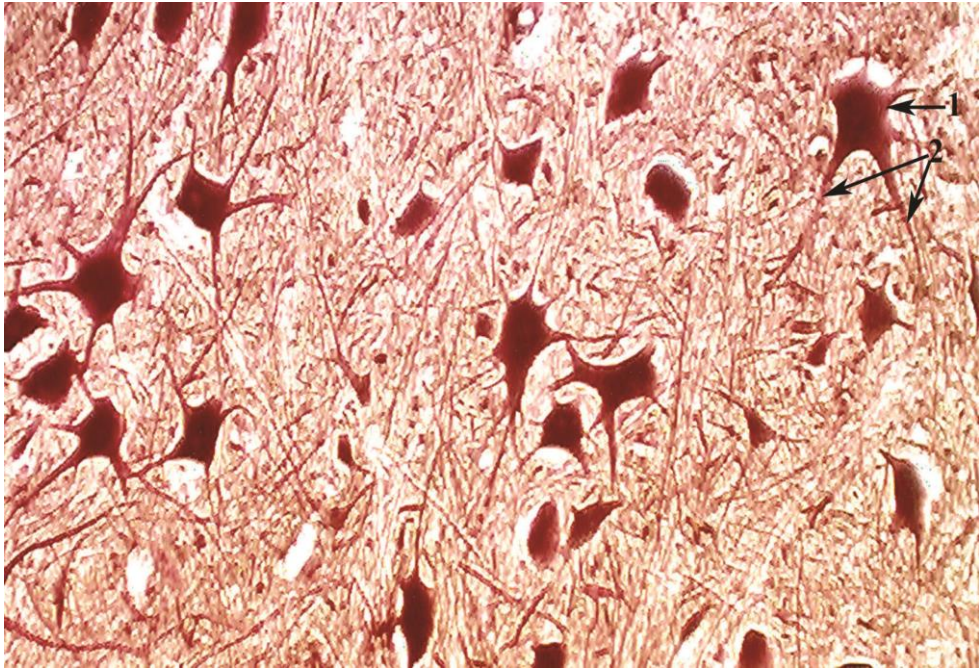
Şəkil 1.5.

Рисунок 1.5.

Figure 1.5.

Polyhedral liver cells. Stain: hematoxylin-eosin.

1.liver cell – hepatocyte 2.nucleus 3.cytoplasm 4.cell border 5.blood vessel.



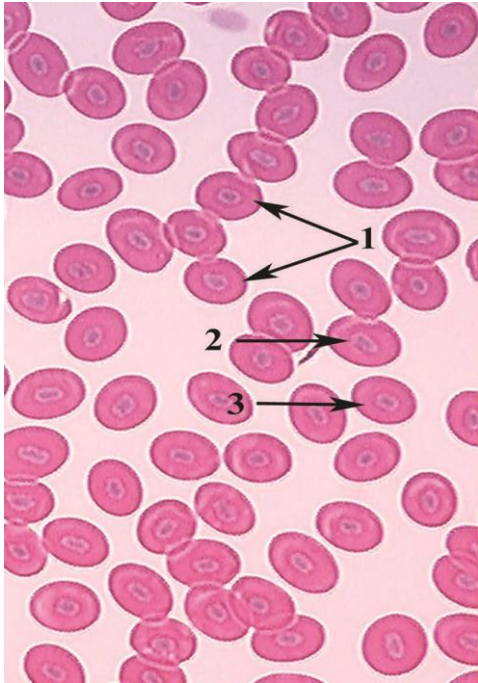
Şəkil 1.6.

Рисунок 1.6.

Figure 1.6.

Nerve cells. Stain: silvering.

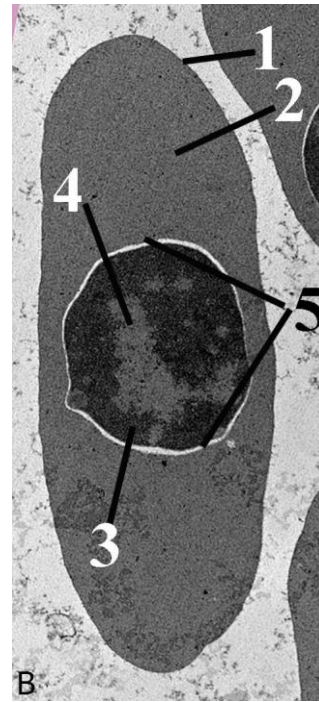
1.body of nerve cell – perikaryon 2.process of nerve cells



Şəkil 1.7.

Рисунок 1.7.

Figure 1.7.



Ovoid erythrocytes.

A Ovoid erythrocytes. Frog blood smear. Giemsa stain.

1.erythrocyte 2.nucleus 3.cytoplasm

B Electron microscopic structure of nucleated erythrocyte

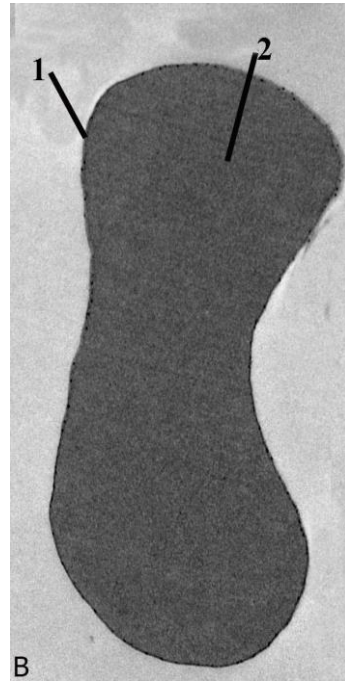
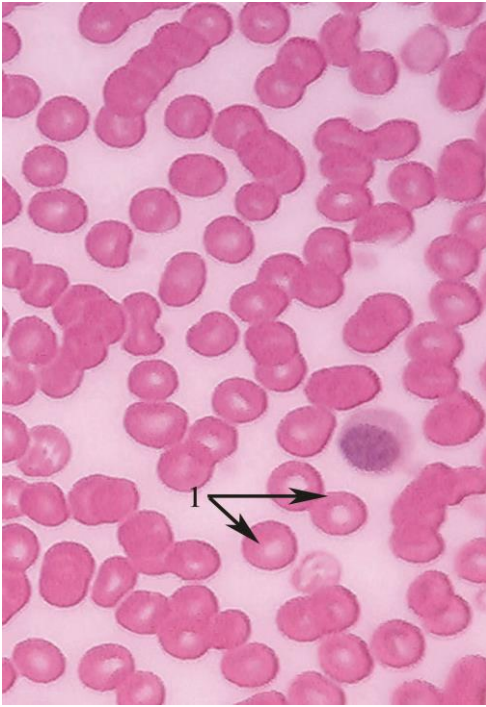
1 plasma membrane of nucleated erythrocyte

2 cytoplasm of nucleated erythrocyte

3 heterochromatin

4 euchromatin

5 nucleus



Şəkil 1.8.

Рисунок 1.8.

Figure 1.8.

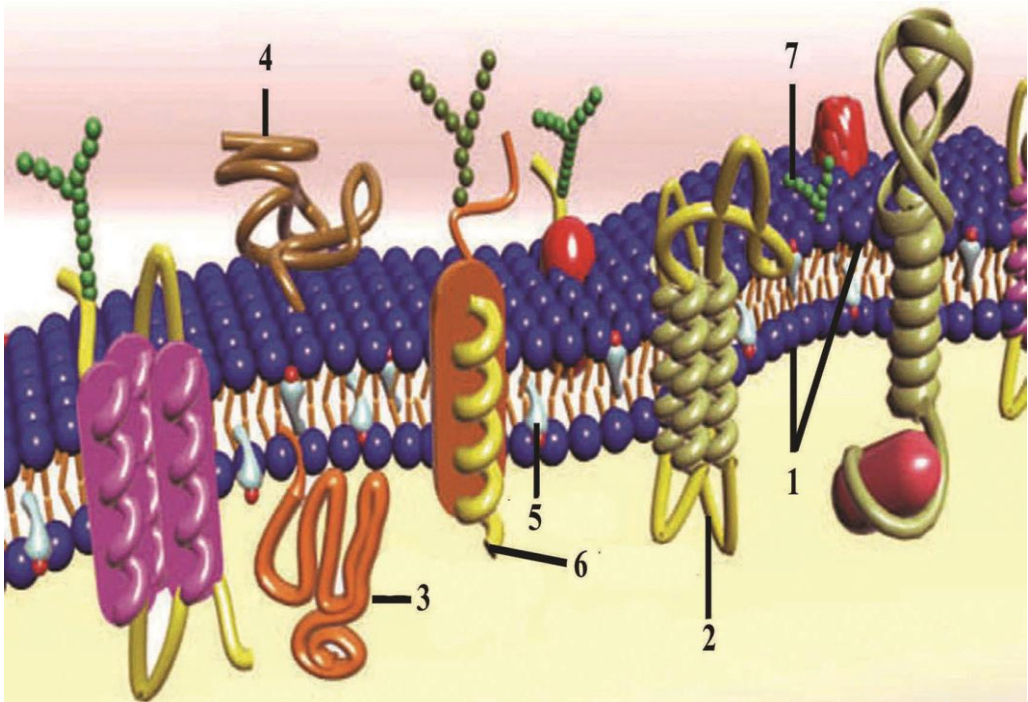
A Ovalşəkilli eritrositlər. İnsan qanı yaxması. Boyaq: Romanovski – Gimza.

1. erythrocyte

B Electron microscopic structure of nonnucleated erythrocyte

1 plasma membrane

2 cytoplasm



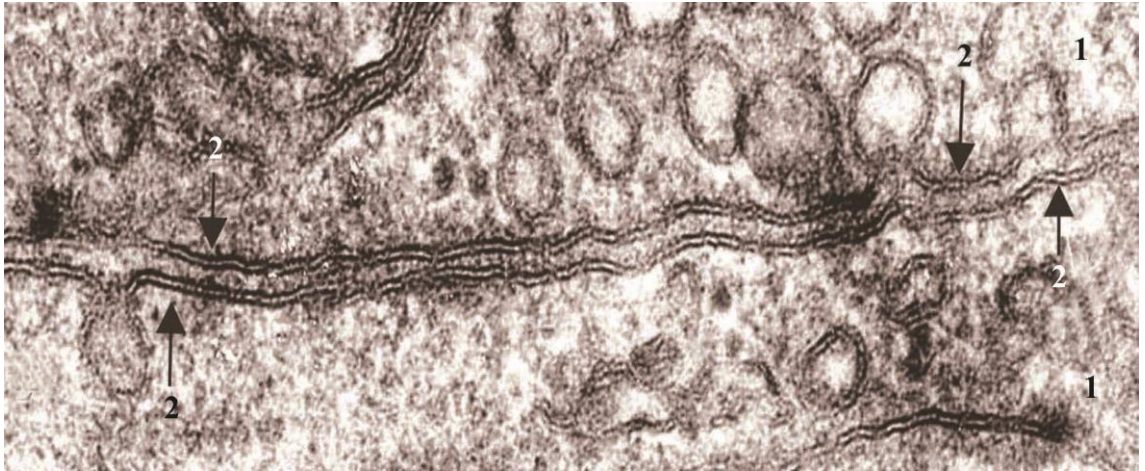
Şəkil 1.9.

Рисунок 1.9.

Figure 1.9.

Schematic representation of fluid-mosaic model of structure of plasma membrane.

1.phospholipids 2.integral protein 3.internal peripheral protein
4.external peripheral protein 5.cholesterol 6.glycoprotein 7.glycolipid



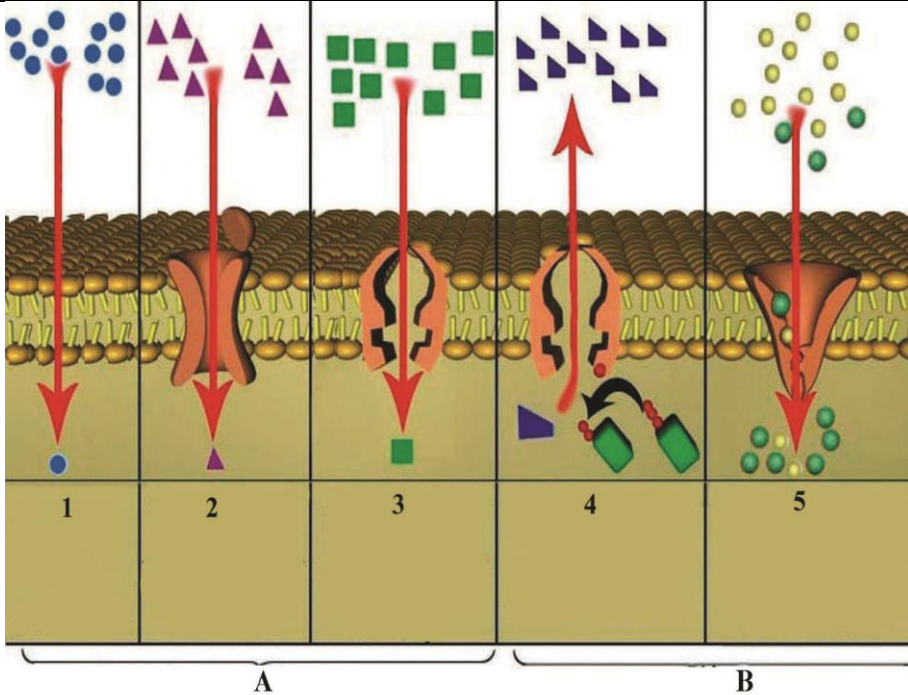
Şəkil 1.10.

Рисунок 1.10.

Figure 1.10.

Electron microscopic structure of plasmalemma (cell membrane) of neighbor endothelial cells.

1. endothelial cells; 2. plasmalemma.



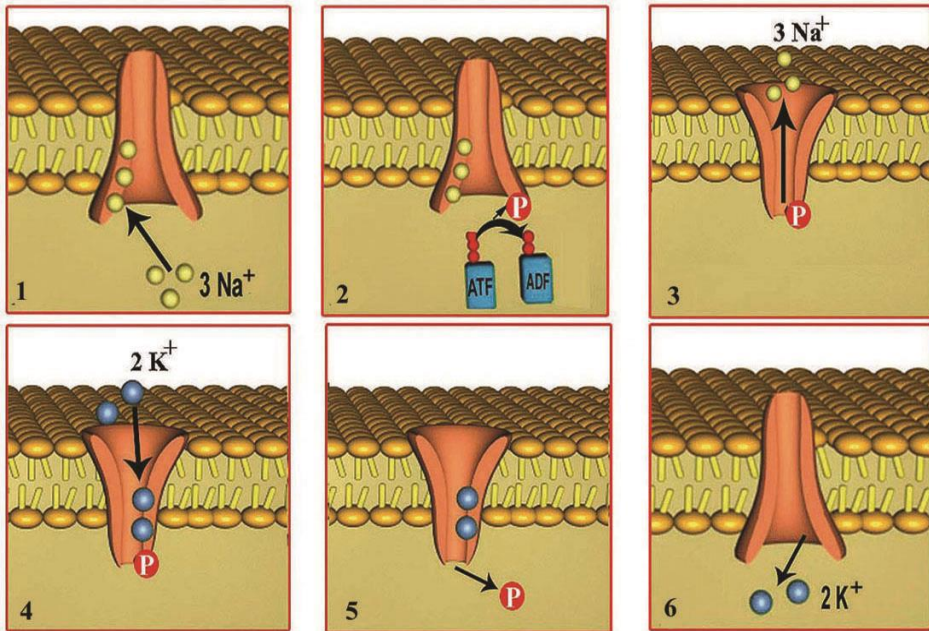
Şəkil 2.1.

Рисунок 2.1.

Figure 2.1.

Types of passive and active transport.

1.simple diffusion 2.channel-mediated diffusion 3.carrier-mediated diffusion 4.pump-mediated transport 5.by concentration difference.



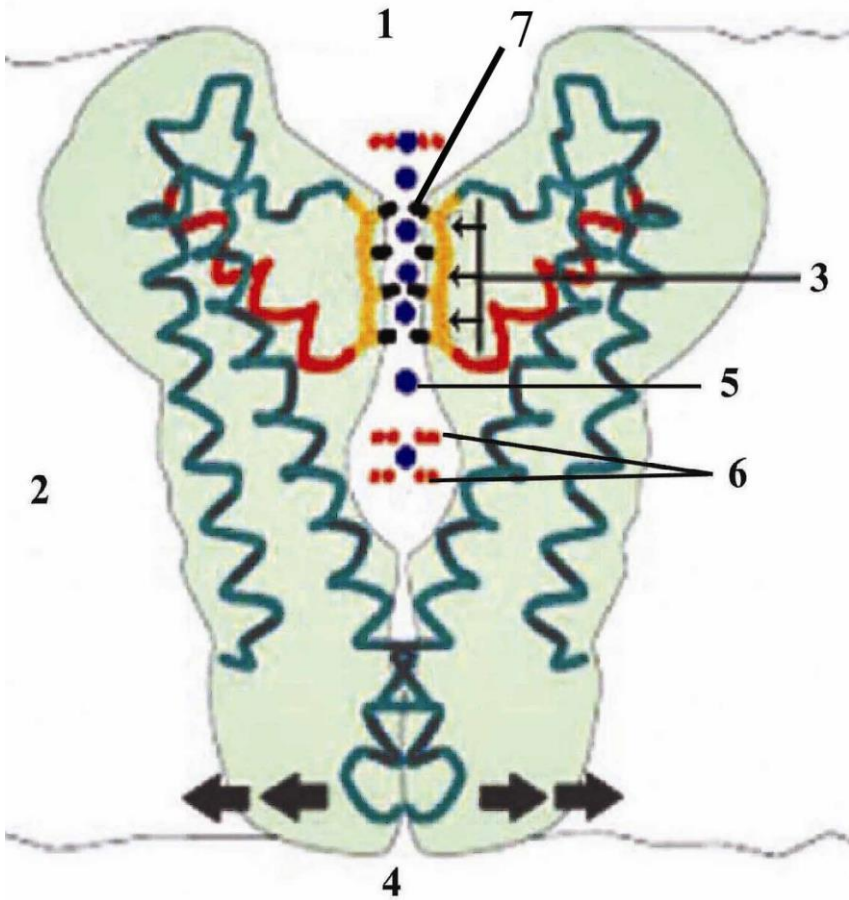
Şəkil 2.2.

Рисунок 2.2.

Figure 2.2.

Schematic representation of functioning of Na^+/K^+ pump.

- 1.binding of 3 Na^+ to cytosolic aspect surface of Na^+/K^+ pump
2. hydrolysis of ATP and phosphorylation of α -subunit
- 3.releasing of Na^+ from cell
- 4.binding of 2 K^+ to external aspect of Na^+/K^+ pump
- 5.dephosphorylation of ATPase
- 6.transfer of K^+ into cell.



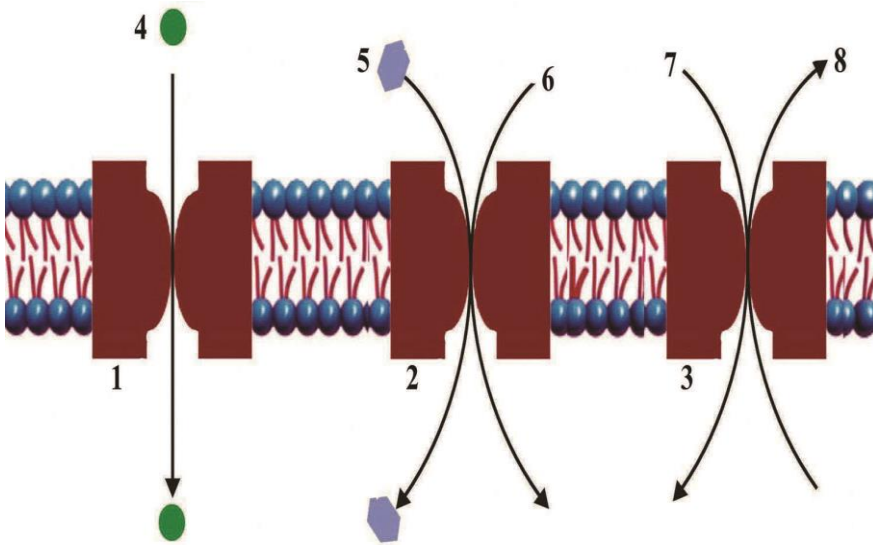
Şəkil 2.3.

Рисунок 2.3.

Figure 2.3.

Schematic representation of gated potassium (K^+) channel.

1.ion channel 2.plasma membrane 3.ion filter 4.gate 5. K^+ ion 6.water molecules.7. oxygen atoms



Şəkil 2.4.

Рисунок 2.4.

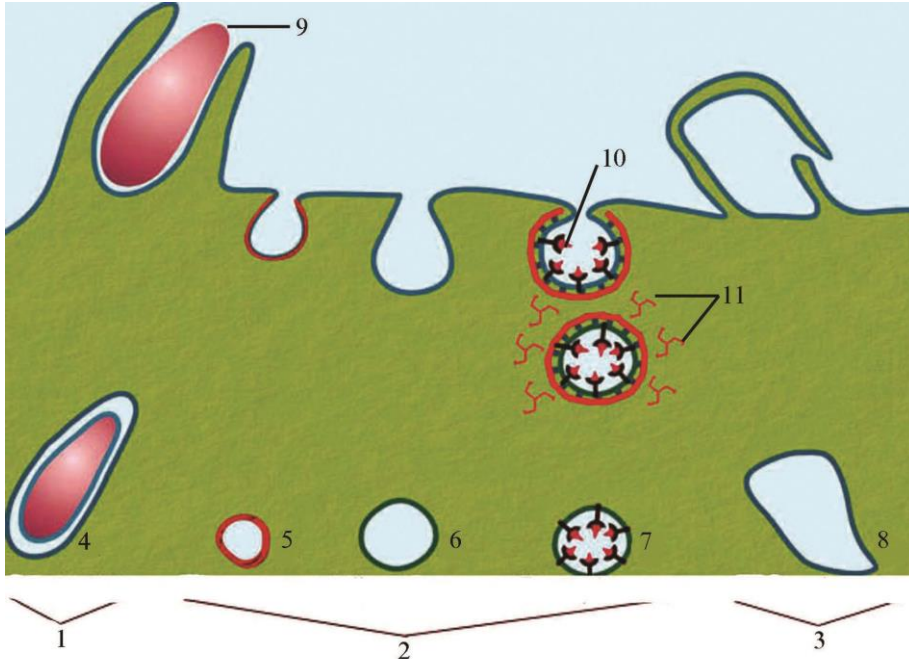
Figure 2.4.

Schematic representation of types of single and coupled transport.

1.single uniport transport 2.symport coupled transport 3.antiport coupled transport 4.amino acid 5.glucose 6.Na⁺ 7.ADP 8.ATP.

Hüceyrə zarı: endositoz və ekzositoz. Hüceyrə zarının reseptor funksiyası.

3



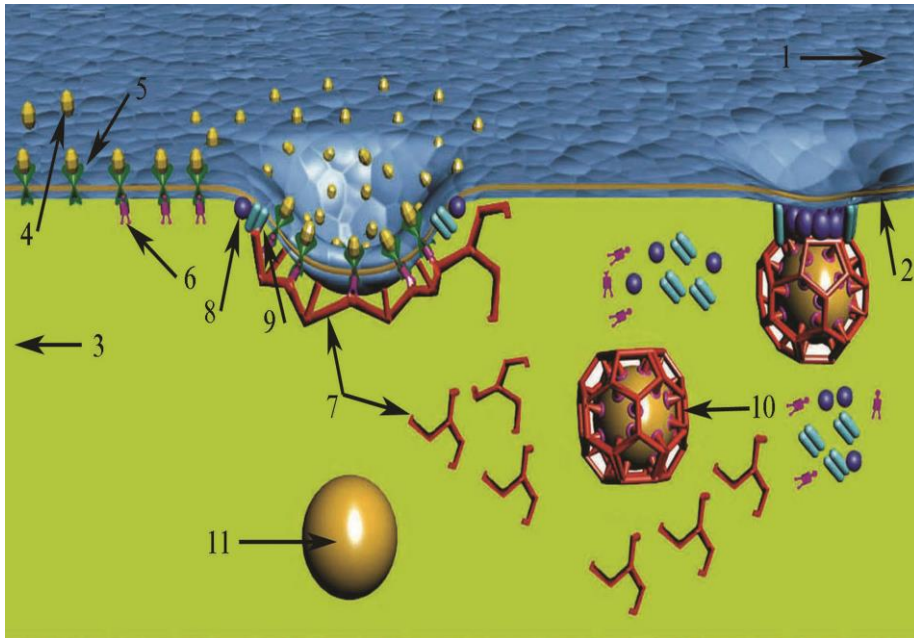
Şəkil 3.1.

Рисунок 3.1.

Figure 3.1.

Kinds of endocytosis. Schem.

1.phagocytosis 2.micropinocytosis 3.macropinocytosis 4.phagosome
5.caveosome 6.micropinosome 7.receptosome 8.macropinosome
9.swallowing particle 10.ligand-receptor complex 11.clathrin.



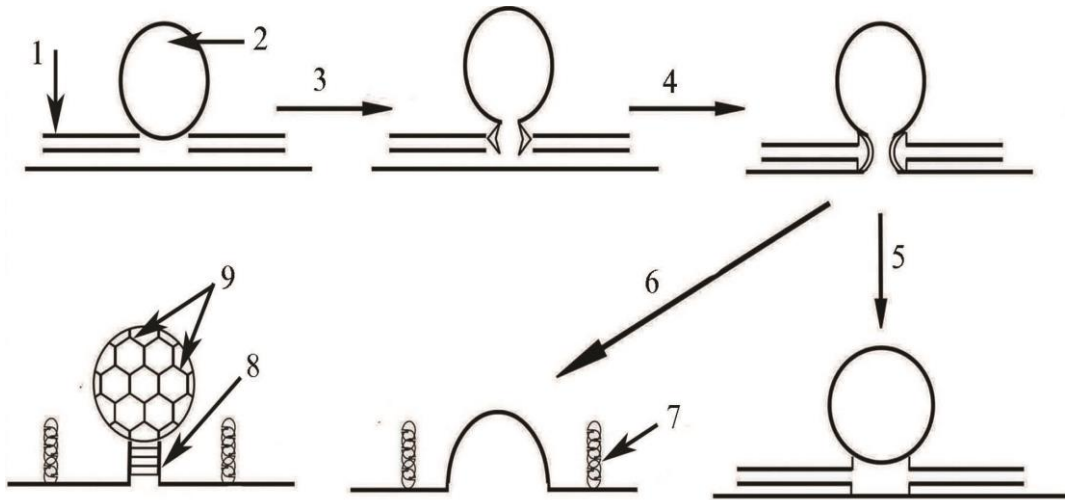
Şəkil 3.2.

Рисунок 3.2.

Figure 3.2.

Schematic diagram of forming mechanism of clathrin-coated pinocytotic vesicle.

1.extracellular environment 2.plasma membrane 3.cytoplasm 4.ligand
 5.receptor 6.AP-2 7.clathrin 8.dynamin 9.amphiphizin 10.clathrin-coated vesicle 11.vesicle that lost clathrin coat.



Şəkil 3.3.

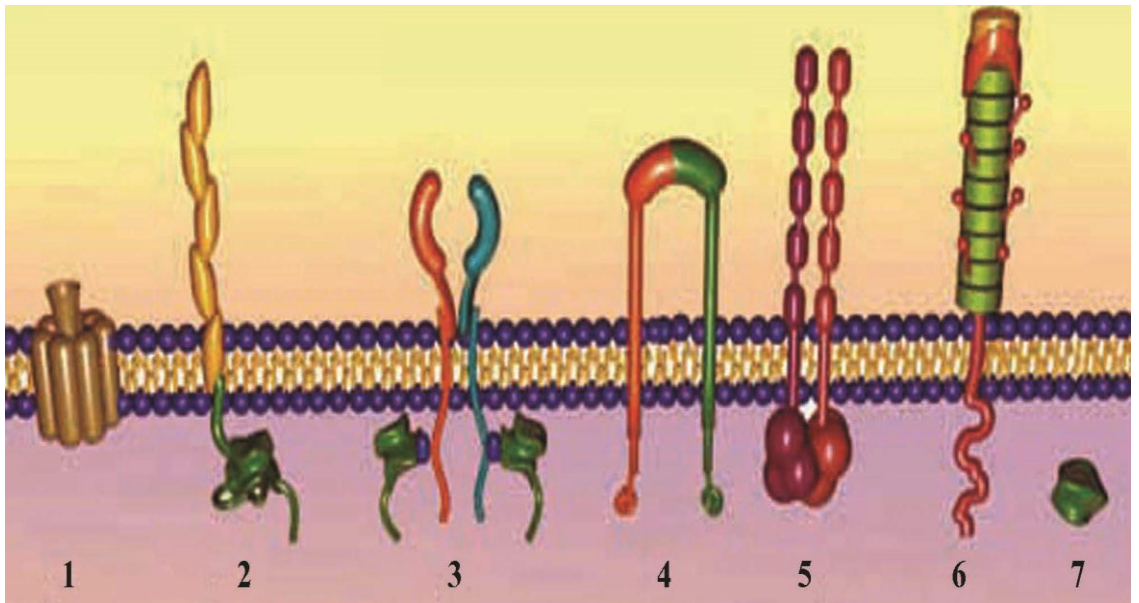
Рисунок 3.3.

Figure 3.3.

Kinds of exocytosis: kiss and run, and complete connection.

Schema.

1.plasma membrane 2.exosome 3.forming of connection pore
 4.expanding of connection pore 5.kiss and run 6.complete connection
 7.SNARE complex 8.dynamin 9.clathrin.



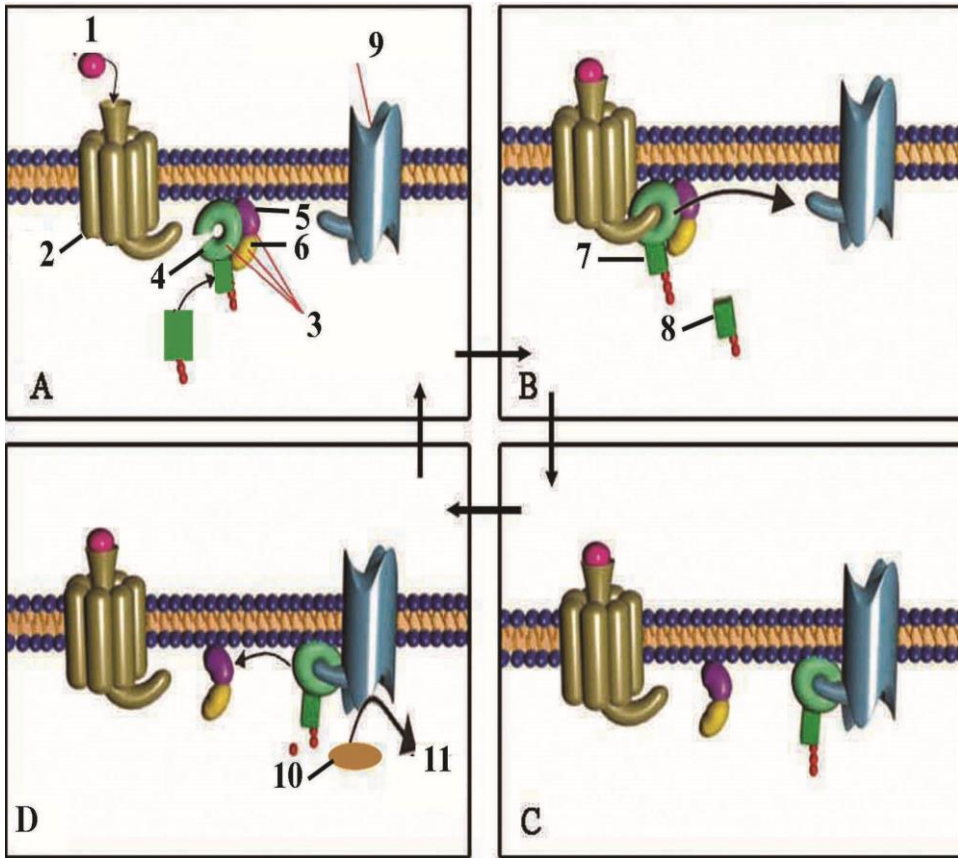
Şəkil 3.4.

Рисунок 3.4.

Figure 3.4.

Schematic representation of membrane and nuclear receptors.

- 1.seven-spiral receptor
- 2.receptor enzyme
- 3.enzyme-linked receptor
- 4.integrin
- 5.cadherin
- 6.selectin
- 7.nuclear receptor.



Şəkil 3.5.

Рисунок 3.5.

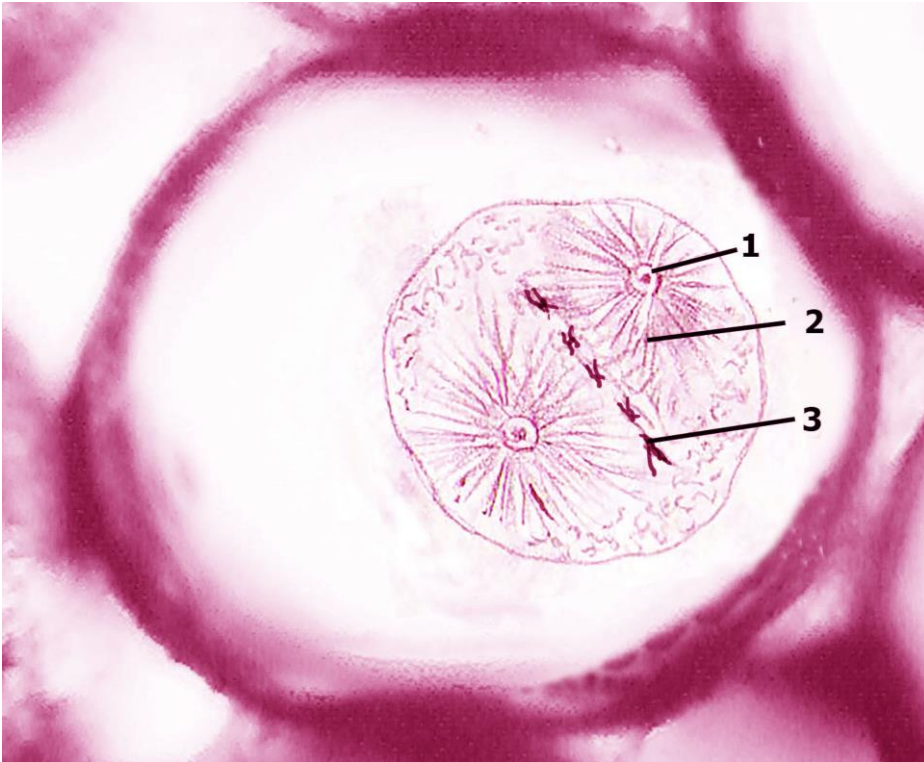
Figure 3.5.

Schematic representation of continual process happening between seven-spiral receptor and adenylatcyclase with participation of G-protein.

1. ligand 2. receptor 3. G-protein 4. α -subunit 5. β -subunit 6. γ -subunit
 7.GTP 8.GDP 9.adenylatcyclase 10.ATP 11.cyclic AMP + pyrophosphate.

**Hüceyrə mərkəzi. Mitoxondri.
Ribosom. Endoplazmatik şəbəkə.**

4



Şəkil 4.1.

Рисунок 4.1.

Figure 4.1.

**Centrosome – cell center in impregnated ovule of horse ascaride.
Stain: ferrous – hematoxylin.**

1. centriole
2. pericentriolar matrix
3. chromosome.



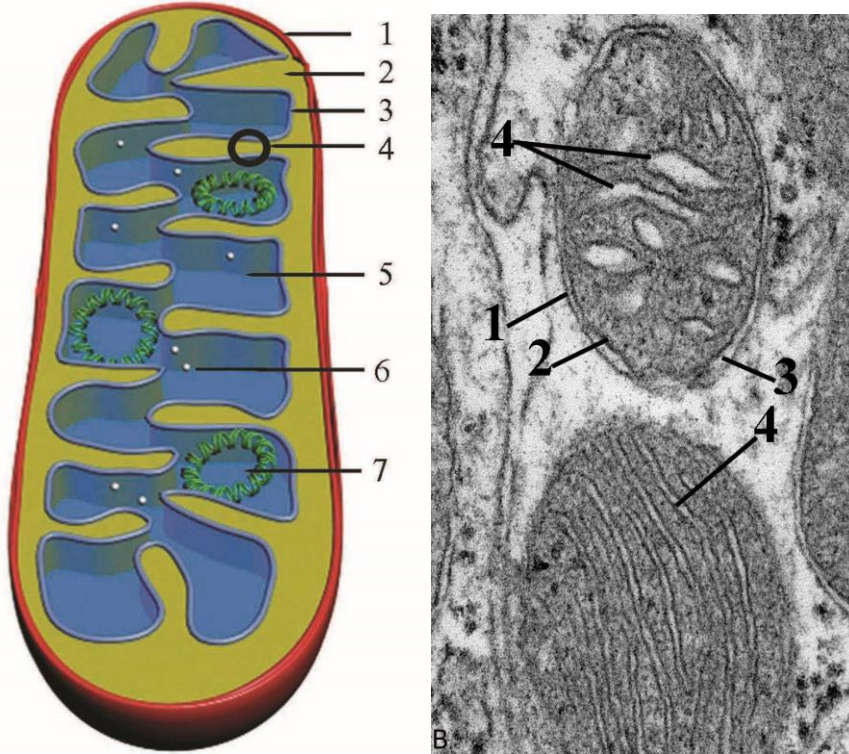
Şəkil 4.2.

Рисунок 4.2.

Figure 4.2.

Schematic representation of the mitochondrion in intestinal epithelial cell.

1. Nucleus
2. Point like mitochondrion
3. Fiber like mitochondrion



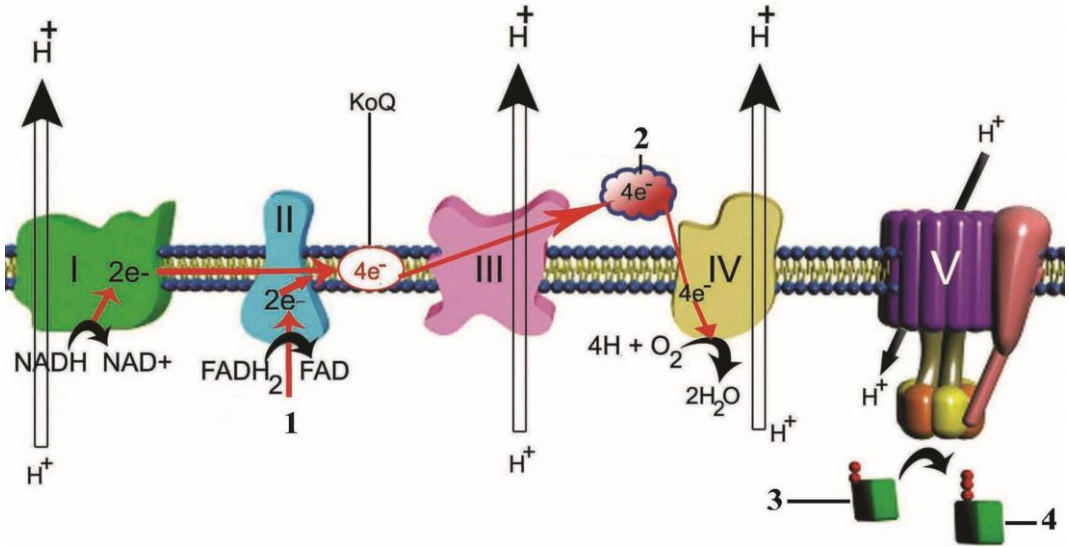
Şəkil 4.3. Рисунок 4.3. Figure 4.3.

A Schematic representation of longitudinal section of mitochondrion.

- 1. outer mitochondrial membrane
- 2. intermembranous space
- 3. mitochondrial crista
- 4. inner mitochondrial membrane
- 5. mitochondrial matrix
- 6. mitochondrial granules
- 7. circular DNA.

B Electron micrograph of mitochondrion.

1. outer mitochondrial membrane
2. inner mitochondrial membrane
3. intermembranous space
4. mitochondrial crista

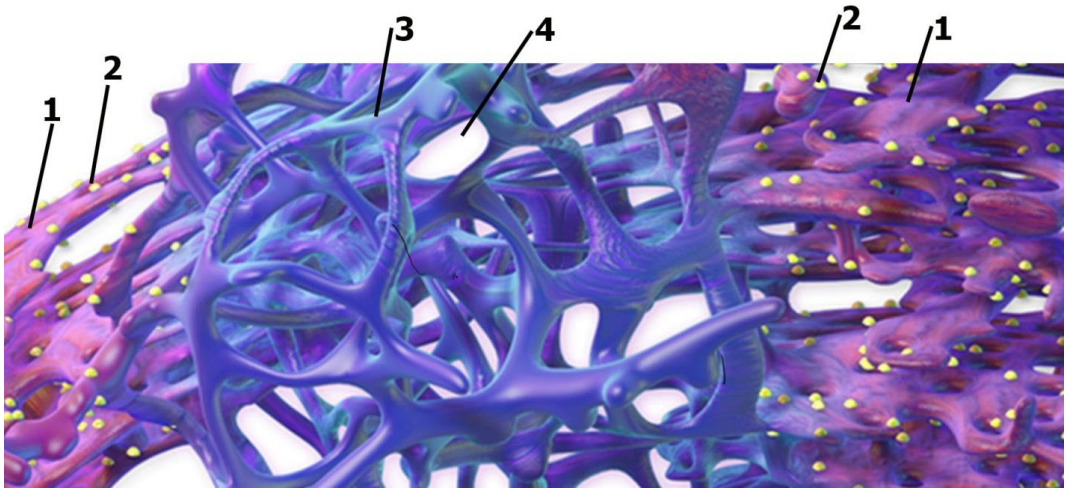


Şəkil 4.4. Рисунок 4.4. Figure 4.4.

Schematic diagram of protein complexes locating in inner mitochondrial membrane.

I-IV – electron transport system (respiratory chain); V – ATP-synthase.

1. succinate
2. cytochrome
3. ADP
4. ATP



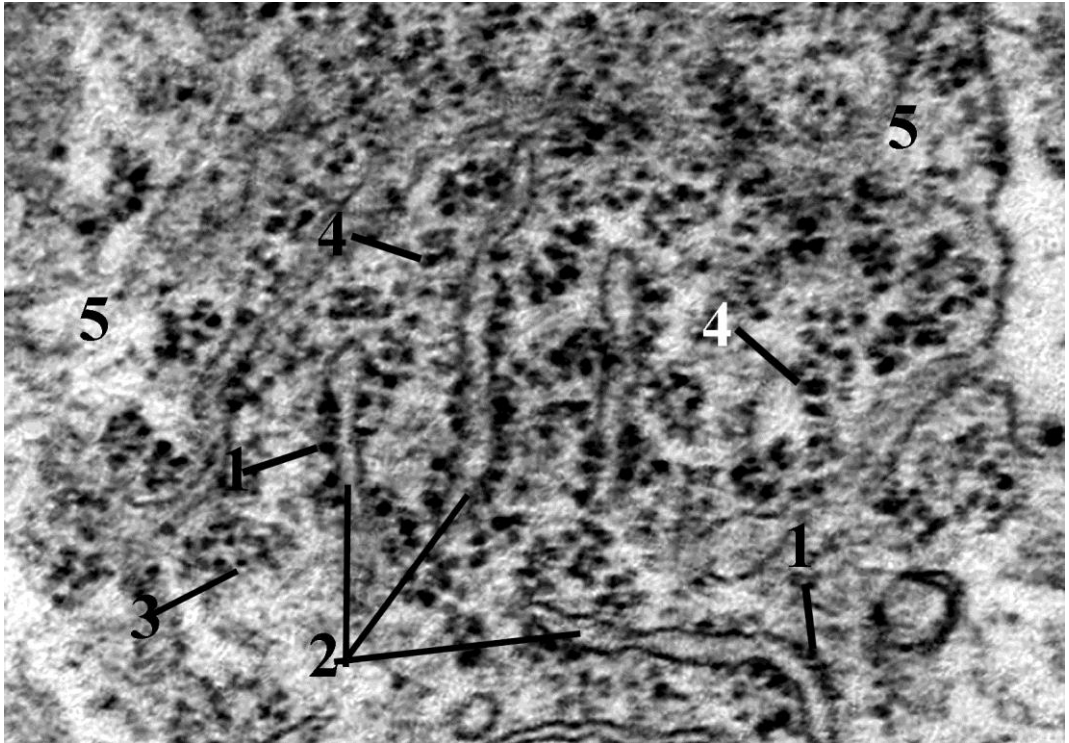
Şəkil 4.5.

Рисунок 4.5.

Figure 4.5.

Schematic representation of the endoplasmic reticulum

1. Rough endoplasmic reticulum
2. Ribosome
3. Smooth endoplasmic reticulum
4. Cytoplasm



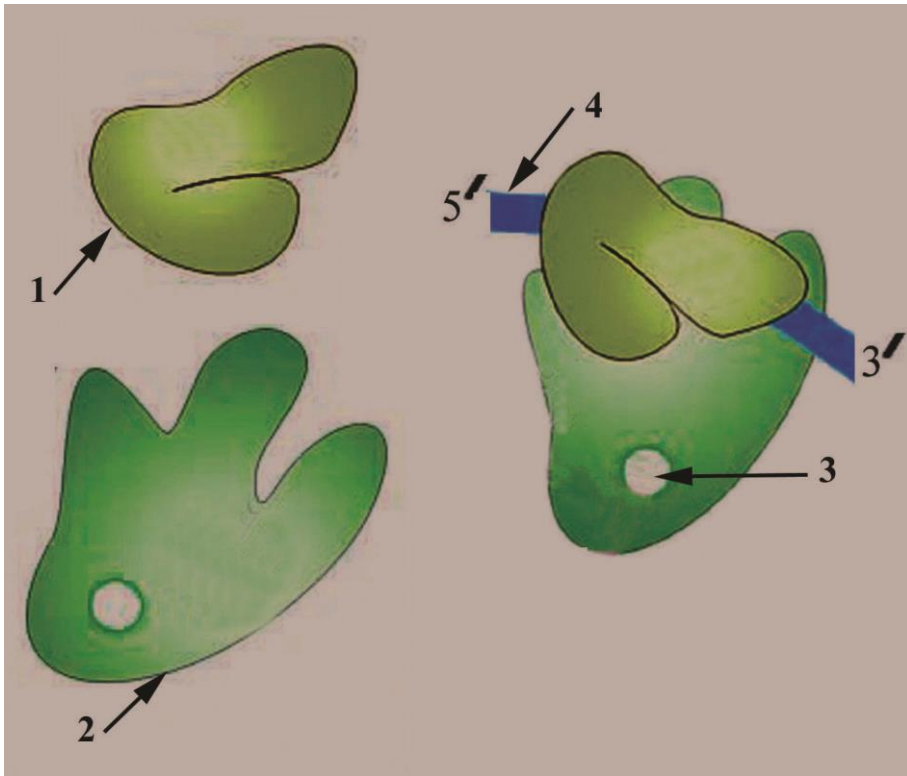
Şəkil 4.6.

Рисунок 4.6.

Figure 4.6.

Electron micrograph of ribosome and endoplasmic reticulum

1. ribosome of rough endoplasmic reticulum
2. cistern of rough endoplasmic reticulum
3. poliribosome
4. free ribosome
5. cytosol



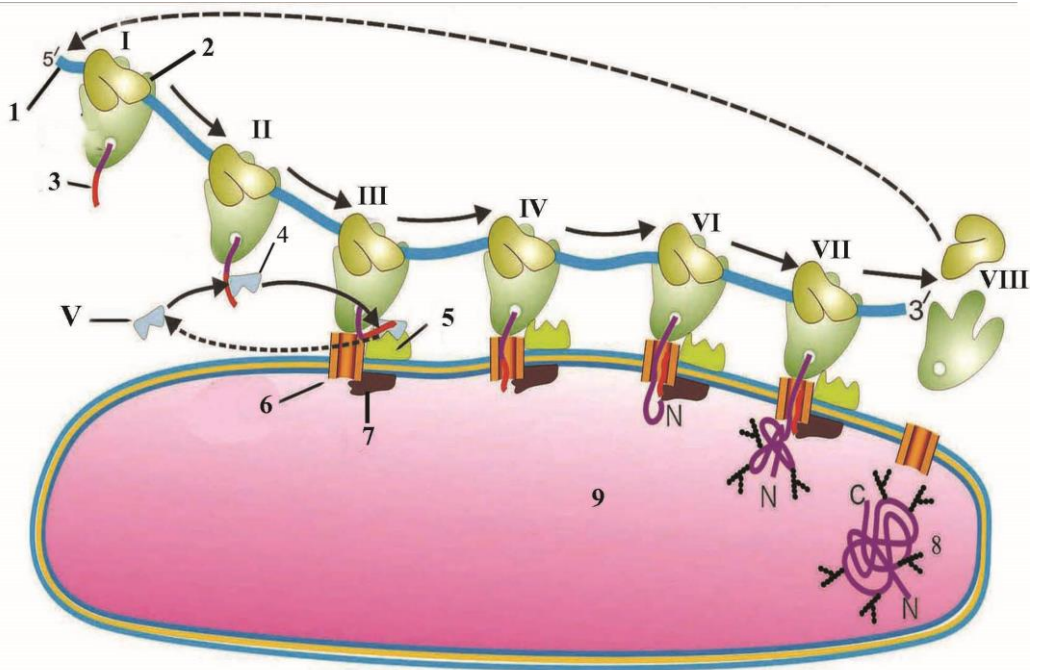
Şəkil 4.7.

Рисунок 4.7.

Figure 4.7.

Schematic representation of ribosome.

1. small subunit
2. large subunit
3. existing pore
4. mRNA.



Şəkil 4.8.

Рисунок 4.8.

Figure 4.8.

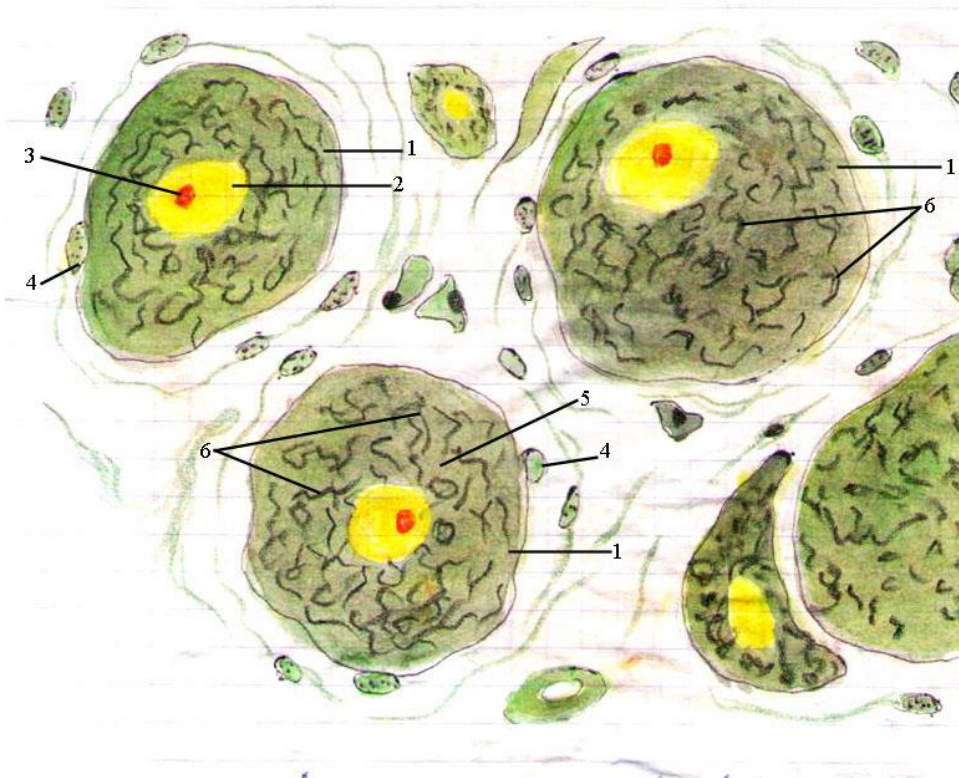
Schematic showing of signal theory of protein synthesis.

I synthesis of signal peptide II binding of signal peptide with signal-recognition particle (SRP) III binding of SRP with receptors IV entering of protein into rough endoplasmic reticulum V liberation of signal peptide from protein VI Growing polypeptide VII Terminal period of protein synthesis VIII separation of ribosomal subunits

1. mRNA
2. ribosome
3. signal peptide
4. signal-recognition particle
5. SRP receptor
6. Sec61 protein
7. signal peptidase.
8. synthesized protein
9. cistern of rough endoplasmic reticulum

**Holci kompleksi. Endosom. Lizosom.
Proteasom. Peroksisom.
Sitoplazmatik əlavələr.**

5



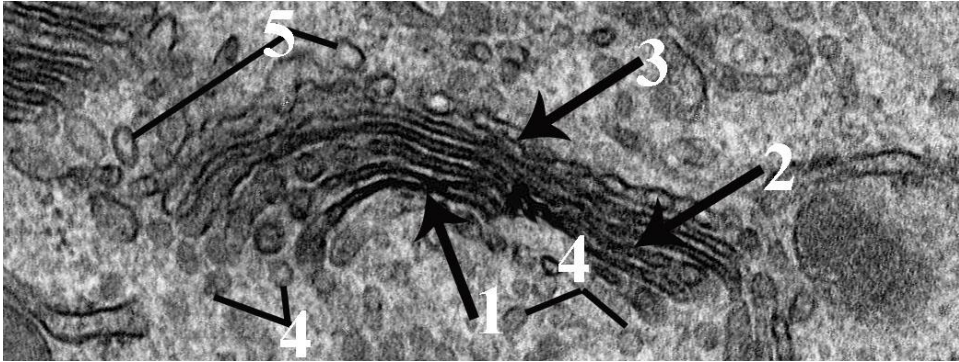
Şəkil 5.1.

Рисунок 5.1.

Figure 5.1.

**Golgi complex in pseudounipolar neurons of spinal ganglion.
Stain: osmic acid.**

1. neurons
2. nucleus
3. nucleolus
4. satellite cell
5. cytoplasm
6. Golgi complex.



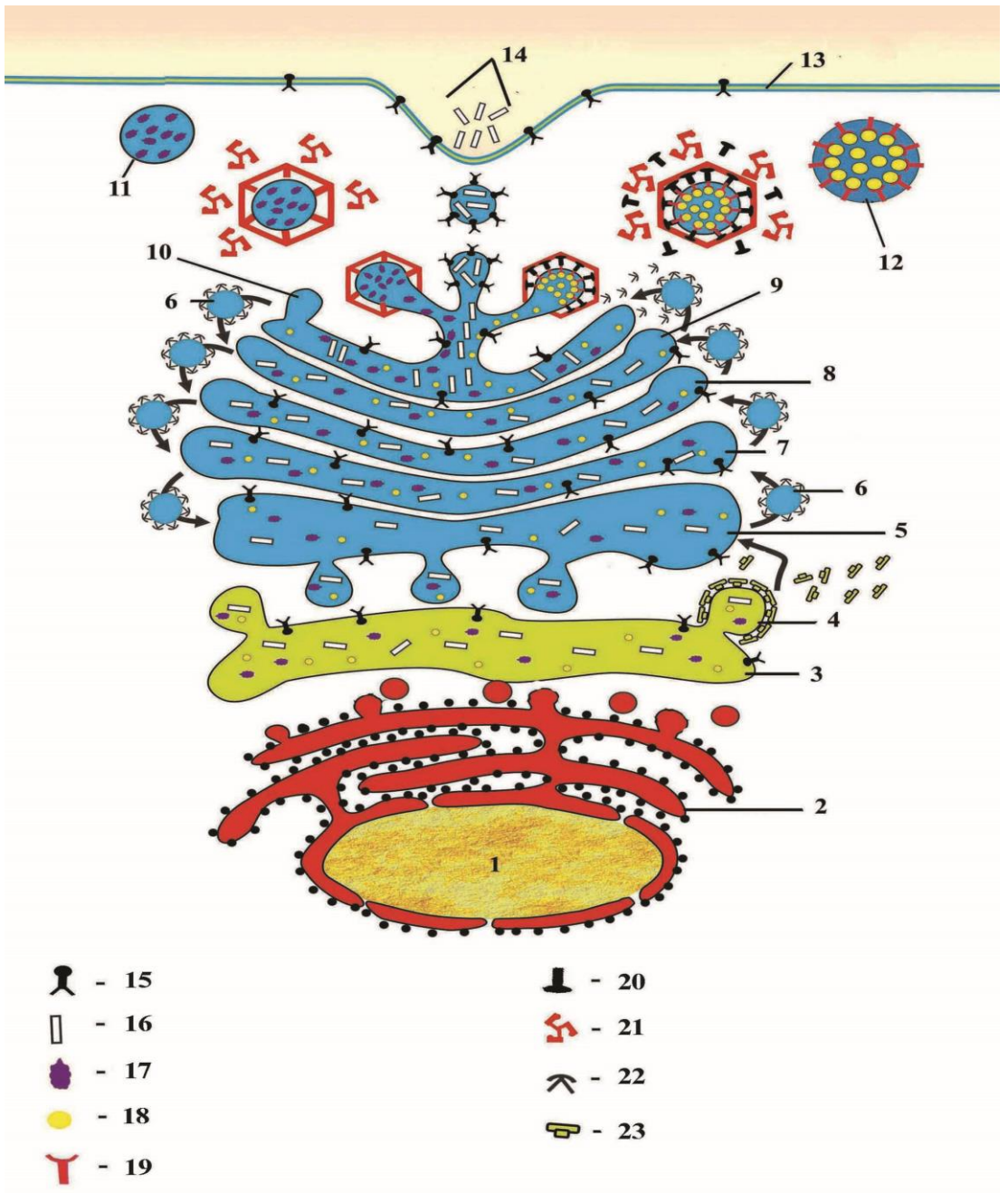
Şəkil 5.2.

Рисунок 5.2.

Figure 5.2.

Electron micrograph of Golgi complex and surrounding structure

1. trans face
2. medial face
3. cis face
4. secretory vesicle
5. transport vesicles



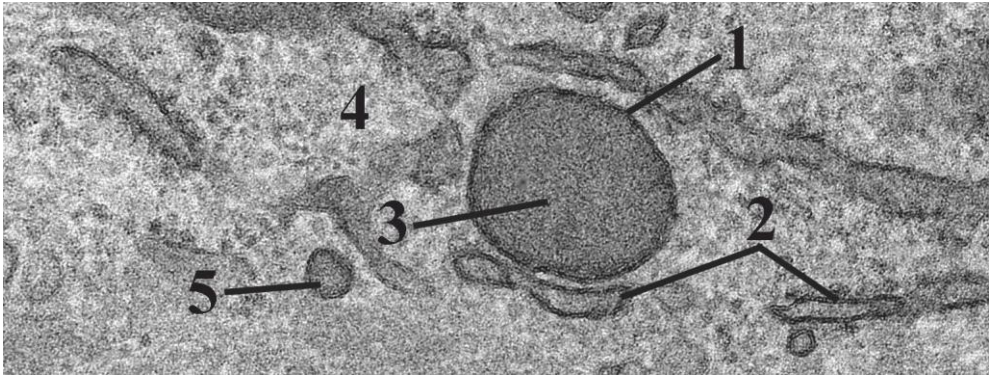
Şəkil 5.3.

Рисунок 5.3.

Figure 5.3.

Schematic representation of structures including to cellular secretory compartment.

1. nucleus
2. rough endoplasmic reticulum
3. transitional endoplasmic reticulum
4. COP II coated vesicle
5. proximal tubulovesicular complex
6. COP I coated vesicle
7. cis face
8. medial face
9. trans face
10. distal tubulovesicular complex
11. secretor vesicle
12. primary lysosome
13. plasma membrane
14. Constitutive secretion.
15. plasmolemma's protein
16. Constitutive secreted protein
17. regulatory secreted protein
18. lysosomal enzymes
19. mannose 6 phosphatase
20. receptor for mannose 6 phosphatase
21. clathrin
22. COP I protein
23. COP II protein



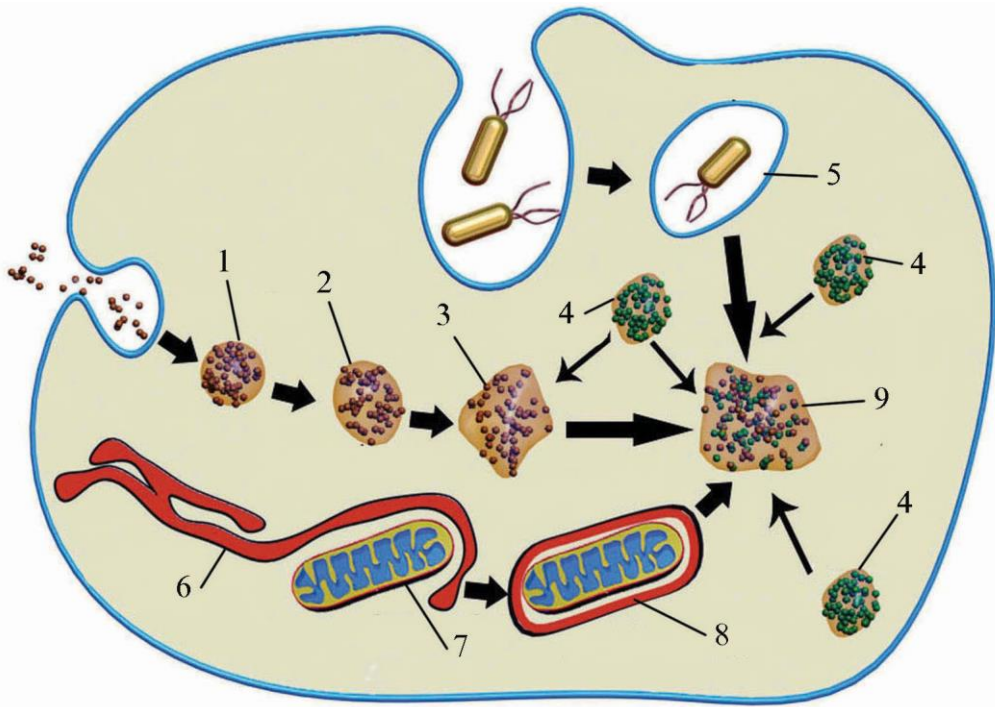
Şəkil 5.4.

Рисунок 5.4.

Figure 5.4.

Electron micrograph of lysosome and surrounding structures

1. plasma membrane of lysosome
2. Cistern of smooth endoplasmic reticulum
3. Matrix of lysosome
4. cytosol
5. secretory vesicle



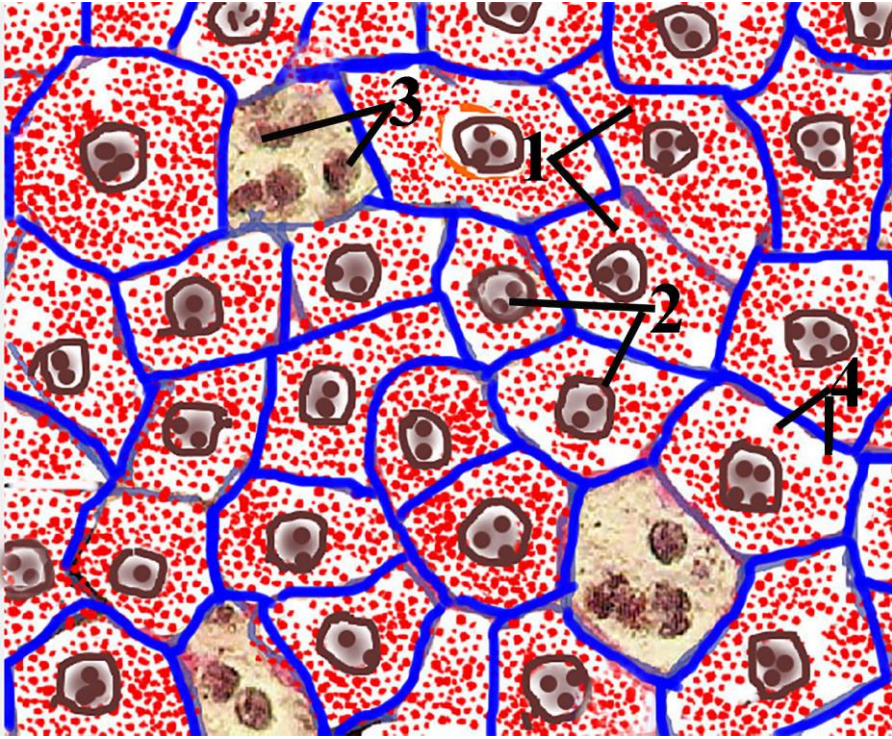
Şakil 5.5.

Рисунок 5.5.

Figure 5.5.

Interaction of structures formed in the cytosol during endocytosis, exocytosis and autophagy with I- and II lysosomes. Scheme

1. endocytosis
2. early endosome
3. late endosome
4. primary lysosomes
5. heterophagosome
6. smooth endoplasmic reticulum
7. mitochondria
8. autophagosome
9. secondary lysosomes



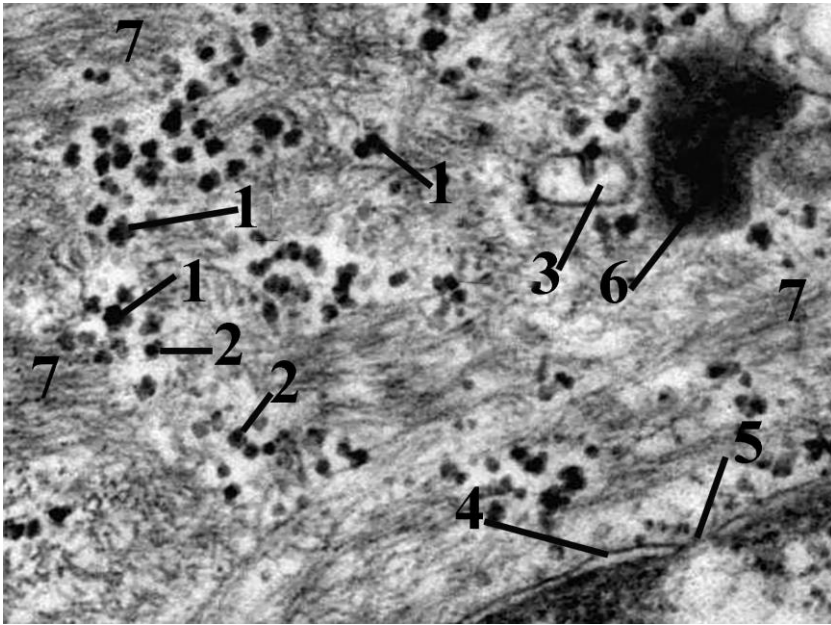
Şakil 5.6.

Рисунок 5.6.

Figure 5.6.

**Histological structure of glycogen inclusions in liver cells.
Best's carmine stain.**

1. Cytoplasm of liver cell –hepatocyte
2. Nucleus of hepatocyte
3. Formed elements of blood
4. glycogen inclusions



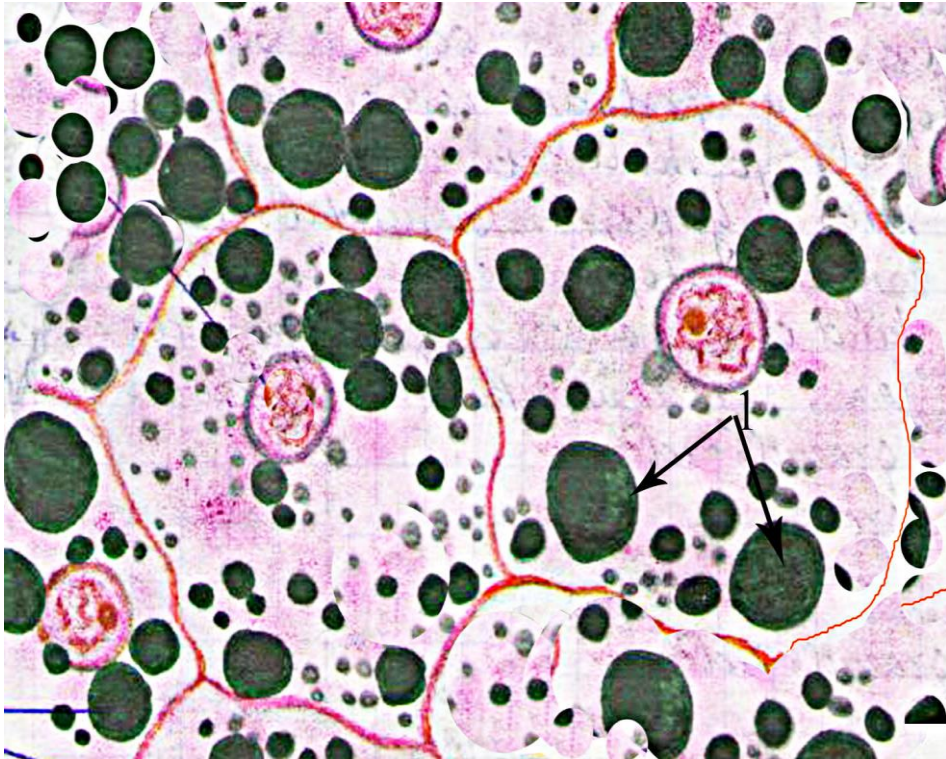
Şəkil 5.7.

Рисунок 5.7.

Figure 5.7.

Electron micrograph of glycogen granules situated in cytoplasm of keratinocyte and surrounding structure.

1. α -granules
2. β - granules
3. smooth endoplasmic reticulum
4. outer nuclear membrane
5. nuclear pore
6. lysosome
7. intermediate filament



Şəkil 5.8.

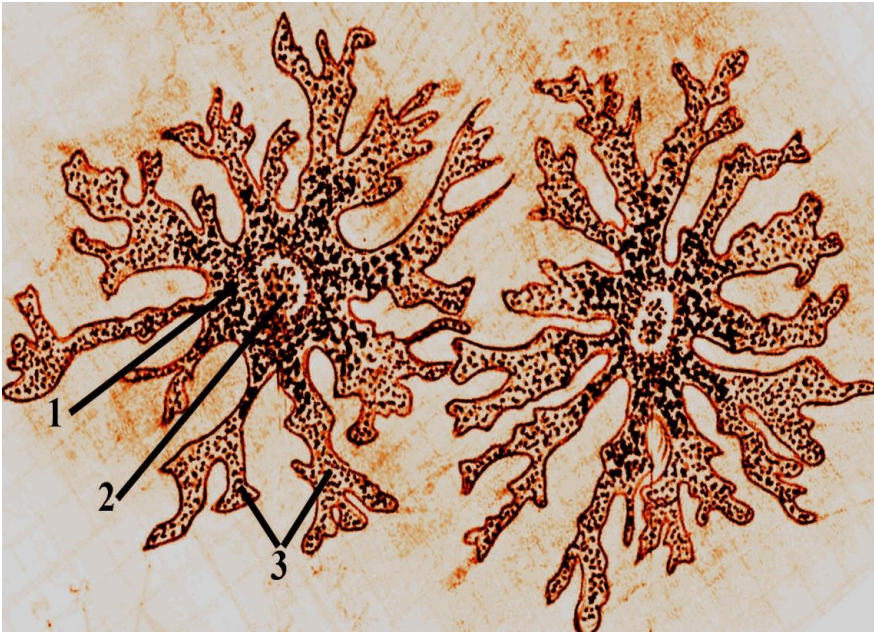
Рисунок 5.8.

Figure 5.8.

Fat droplets in liver cells.

Stain: osmic acid – safranin.

1. fat droplets



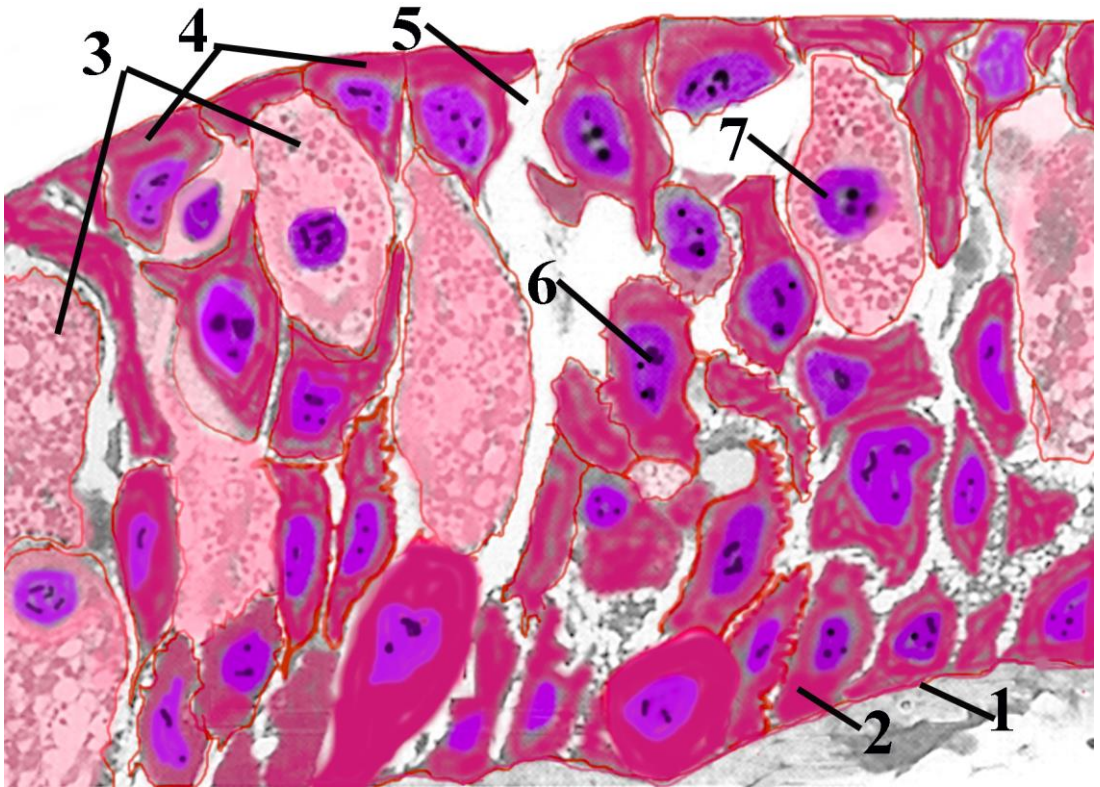
Şəkil 5.9.

Рисунок 5.9.

Figure 5.9.

Pigment inclusions in melanocyte. Uncolored.

1. pigment cell – melanocyte
2. nucleus
3. melanin granules.



Şəkil 5.10.

Рисунок 5.10.

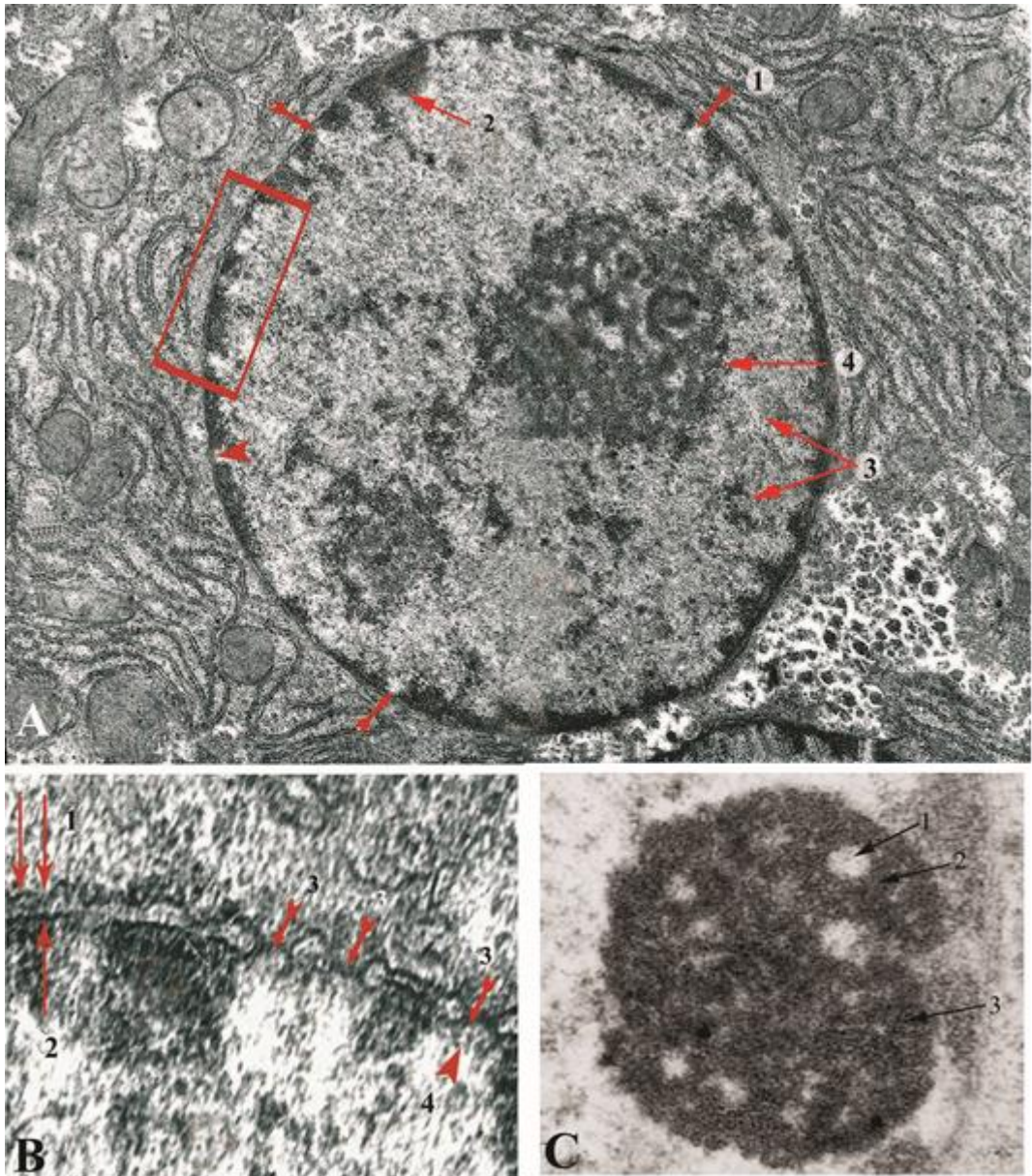
Figure 5.10.

**Electron micrograph of secretory granules in the Leydig cells of axolots skin.
Scheme. Stain: hematoxylin-eosin.**

- 1 basal membrane**
- 2 cells of stratum basale**
- 3 cytoplasm of Leydig cells**
- 4 epidermal cell**
- 5 intercellular space in superficial layer of skin**
- 6 nucleolus of Leydig cells**
- 7 nucleus of Leydig cells**

**Nüvə. Nüvə örtüyü. Nukleoplazma.
Xromatin. Nüvəcik.**

6



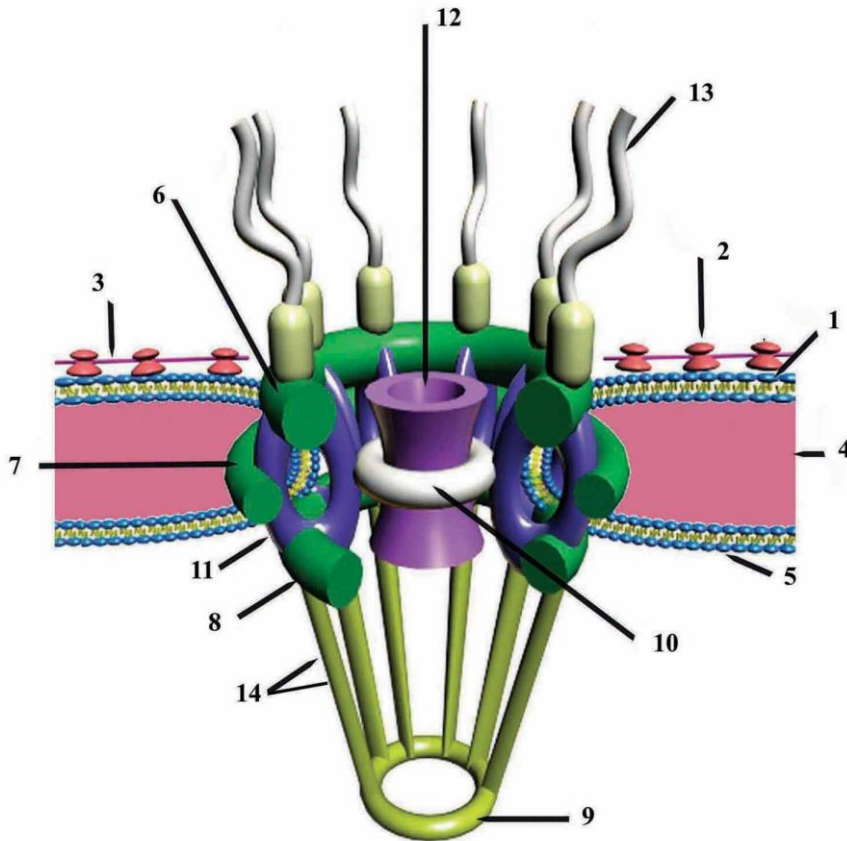
Şəkil 6.1.

Рисунок 6.1.

Figure 6.1.

Electron micrograph of nucleus and its structural elements.

1. nuclear envelope; 2. heterochromatin; 3. euchromatin; 4. nucleolus; 5. outer nuclear membrane; 6. inner nuclear membrane; 7. nuclear pore; 8. nuclear pore complex.



Şəkil 6.2.

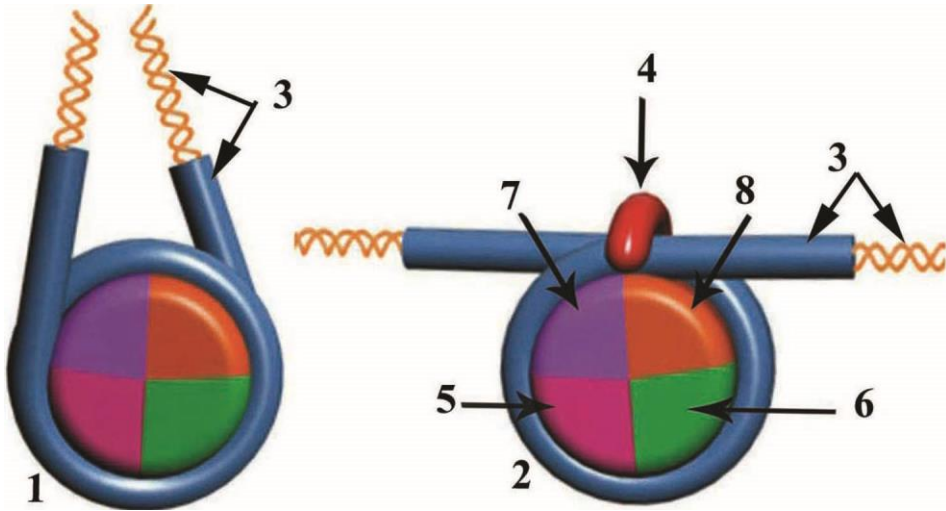
Рисунок 6.2.

Figure 6.2.

Schematic representation of three-dimensional structure of nuclear pore complex.

1. outer nuclear membrane
2. ribosome
3. mRNA
4. perinuclear space
5. inner nuclear membrane
6. cytoplasmic ring
7. luminal (middle) ring
8. nuclear ring
9. terminal ring
10. inner core ring
11. core
12. central part
13. cytoplasmic filament

14. nuclear filaments.



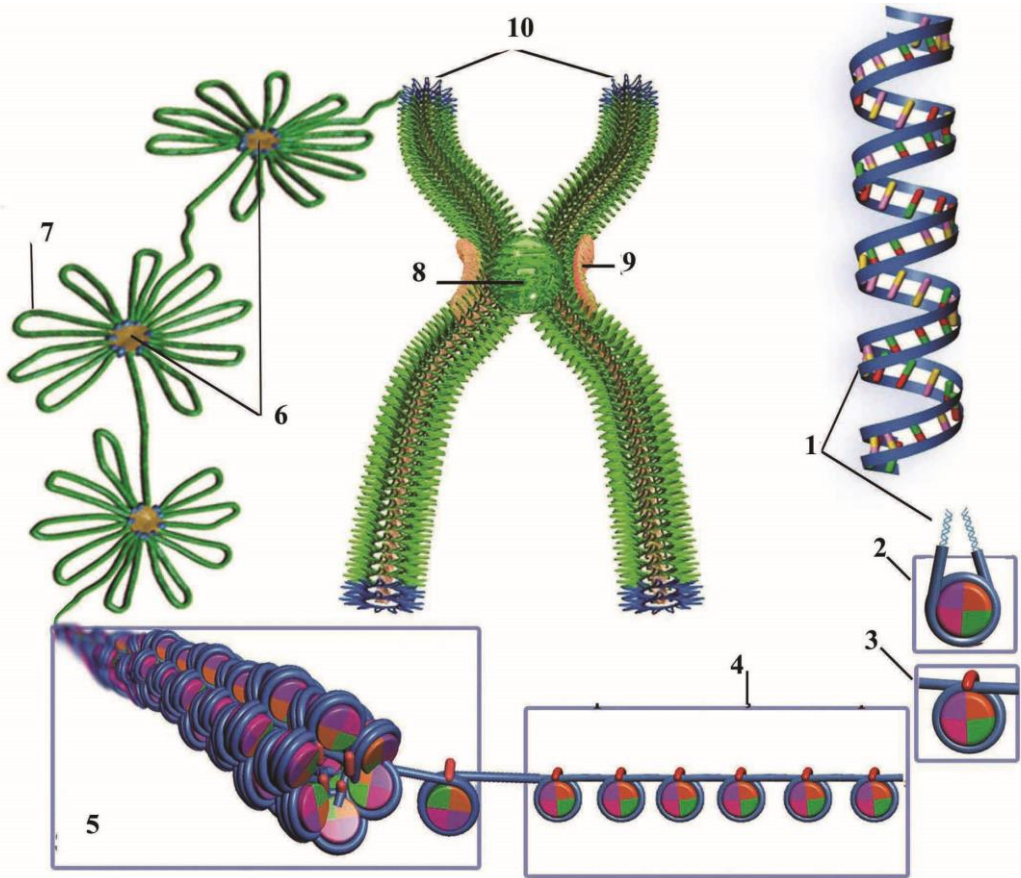
Şəkil 6.3.

Рисунок 6.3.

Figure 6.3.

Schematic representation of nucleosome and chromatosome.

1. nucleosome
2. chromatosome
3. DNA chain
4. H1 protein
5. H2A protein
6. H2B protein
7. H3 protein
8. H4 protein.



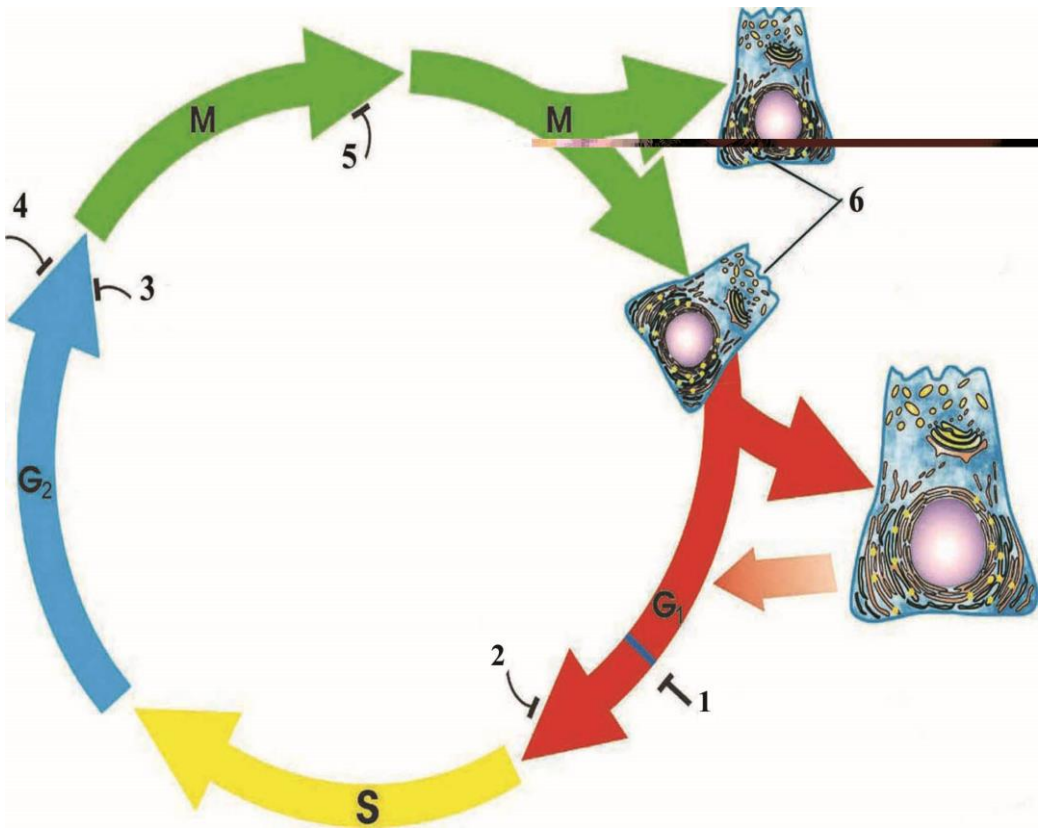
Şəkil 6.4.

Рисунок 6.4.

Figure 6.4.

“Radial-loop” model of structure of metaphase chromosome.

1. DNA
2. nucleosome
3. chromatosome
4. stringing bead
5. solenoid
6. chromosome core
7. chromosome loop (fiber)
8. centromere
9. kinetochore
10. telomere



Şəkil 7.1.

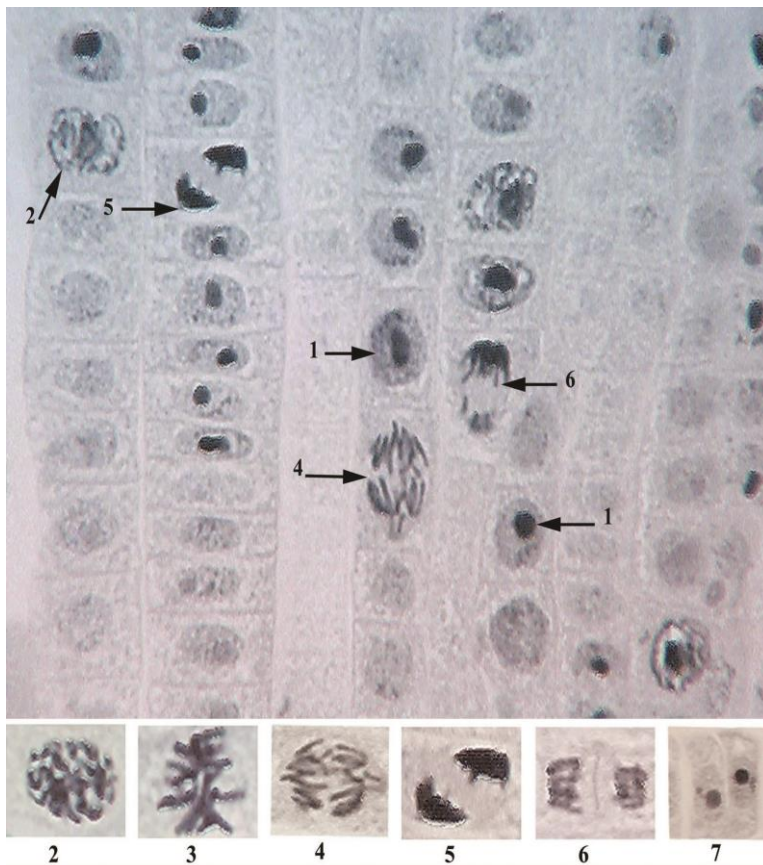
Рисунок 7.1.

Figure 7.1.

Schematic drawing of cell cycle phases and checkpoints.

1. checkpoint regulated the damaging of DNA
2. restriction point of G₁ phase
3. checkpoint regulated correct DNA replication
4. checkpoint regulated correct DNA duplication
5. checkpoint defined the damaging of DNA
6. daughter cells.

3. δ -polymerase
4. leading chain
5. primase
6. α - polymerase
7. Okazaki fragment
8. proteins jointed with single DNA chain
9. primer
10. DNA ligase
11. lagging chain.



Şəkil 7.3.

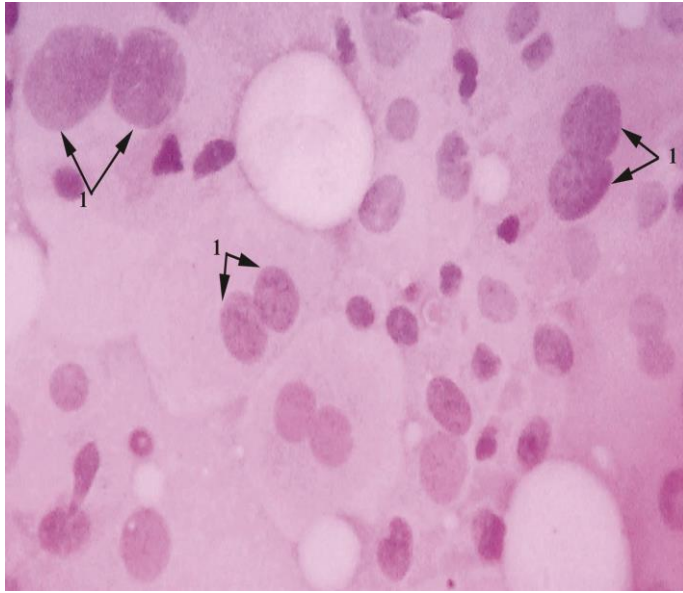
Рисунок 7.3.

Figure 7.3.

Mitosis. In onion root cells.

Stain: ferrous-hematoxylin.

1. interphase
2. and 3. Prophase
4. prometaphase
5. Anaphase
6. telophase
7. Daughter cells.



Şəkil 7.4.

Рисунок 7.4.

Figure 7.4.

Amitosis. In the epithelial cell of urinary bladder mucosa.

Stain: hematoxylin-eosin.

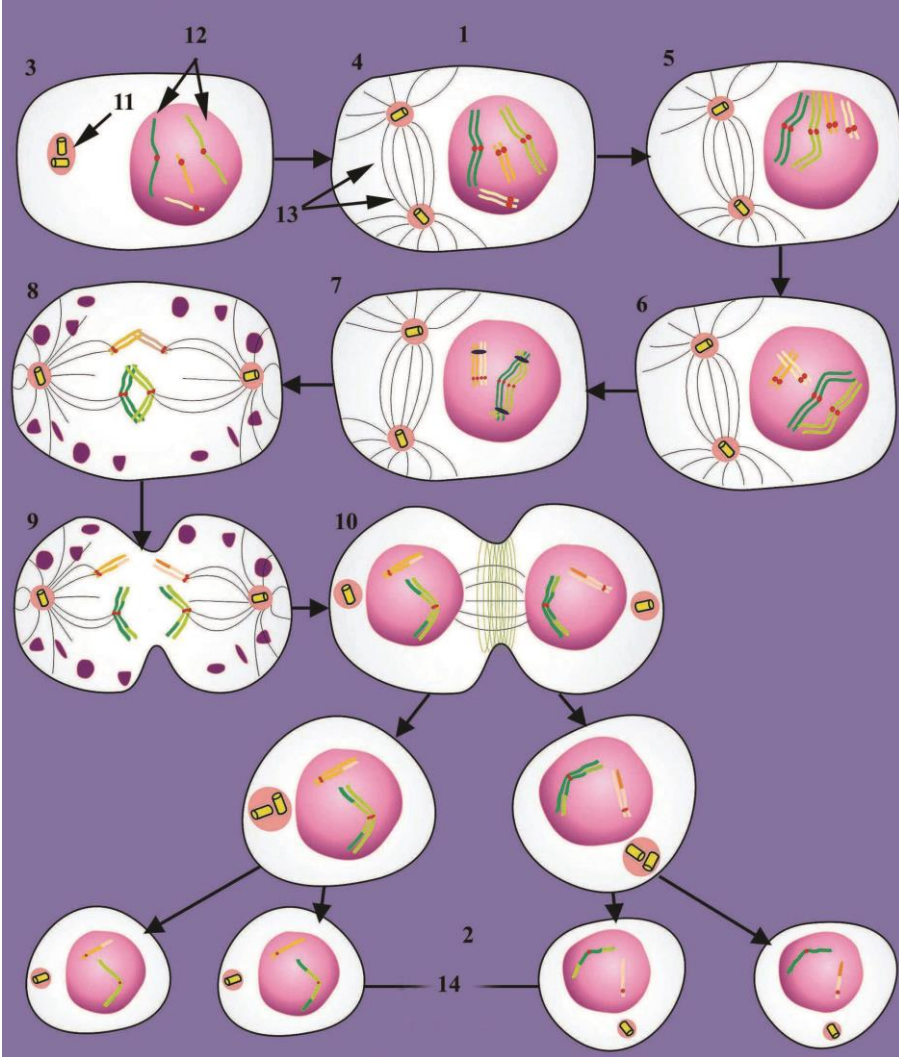
1.daughter cells

I diaqnostikum.

8

Progenez. Meyoz. Cinsi hüceyrələrin quruluşu.

9



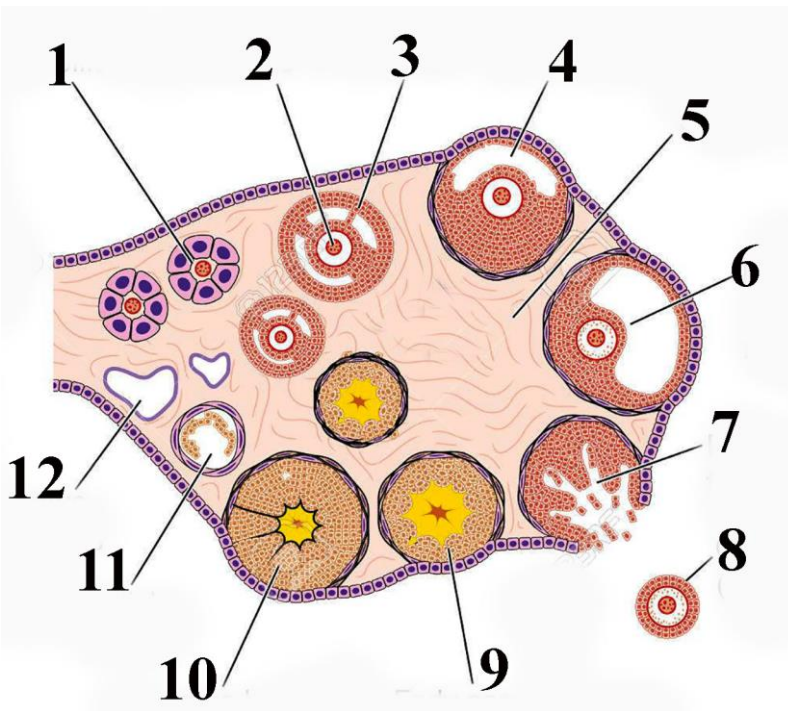
Şəkil 9.1.

Рисунок 9.1.

Figure 9.1.

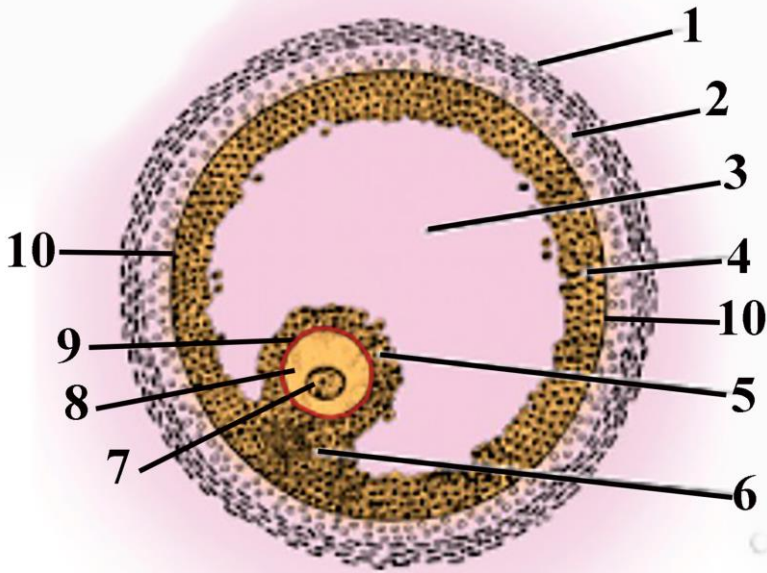
Schematic drawing of different stages of meiotic division in men.

1. I meiosis
2. II meiosis
3. and 4. premeiotic S phase
5. leptotene-zygotene bouquet
6. zygotene
7. pachytene
8. metaphase
9. anaphase
10. telophase
11. centrosome
12. chromosomes
13. mitotic spindle
14. daughter cells.



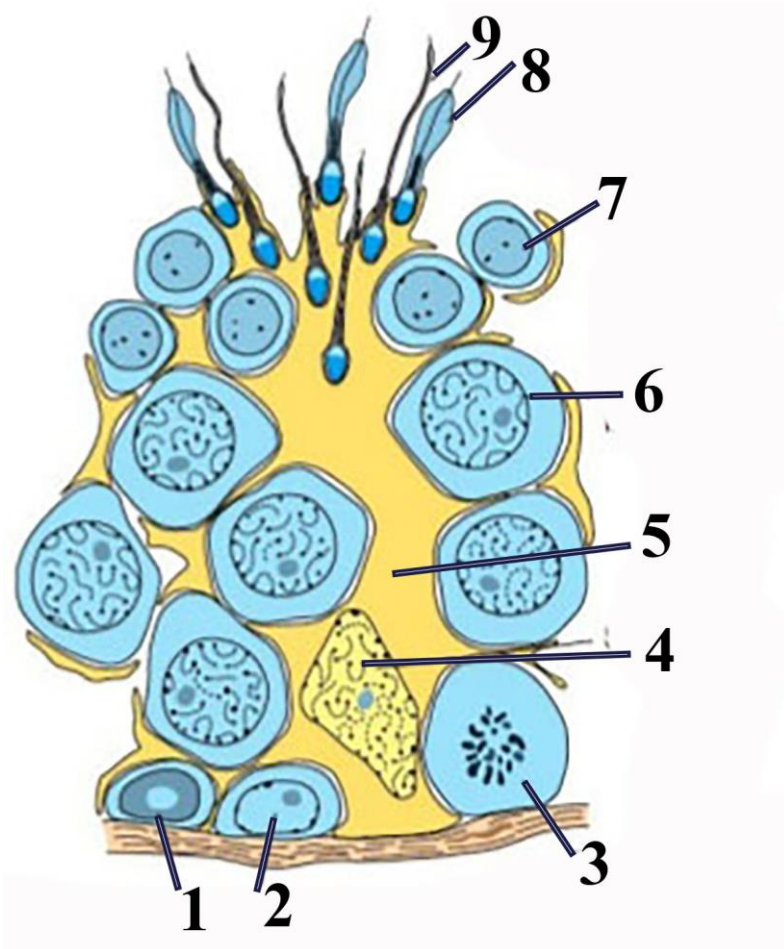
Şəkil 9.2. Рисунок 9.2. Figure 9.2.
 Diagram of ovarian structure and follicular development.

1. primary preantral follicle
2. primary oocyte
3. secondary antral vesicular follicle
4. antrum
5. connective tissue of the ovary
6. mature vesicular Graafian follicle
7. ruptured follicle - ovulation
8. secondary oocyte in 2nd meiotic division
9. formed corpus luteum
10. corpus luteum of pregnancy
11. corpus atreticum
12. corpus albicans



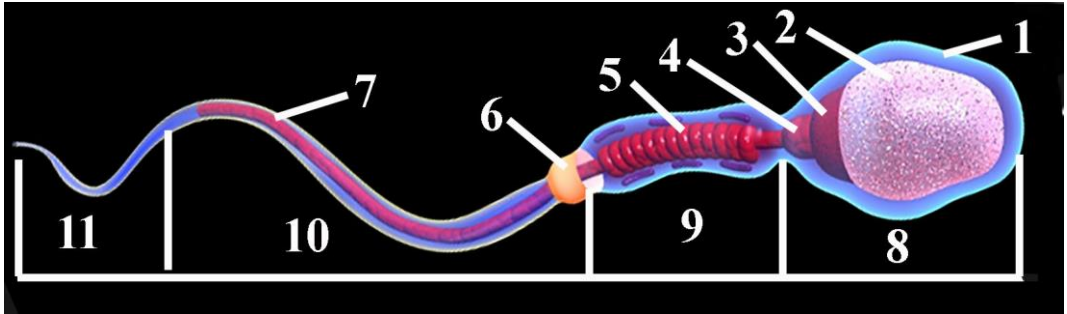
Şəkil 9.3. Рисунок 9.3. Figure 9.3.
 Schematic structure of the mature vesicular Graafian follicle

- 1. theca externa
- 2. theca interna
- 3. antrum
- 4. layer of granulosa cells
- 5. corona radiata
- 6. cumulus oophorus.
- 7. nucleus of primary oocyte
- 8. cytoplasm of primary oocyte
- 9. zona pellucida
- 10. basement membrane



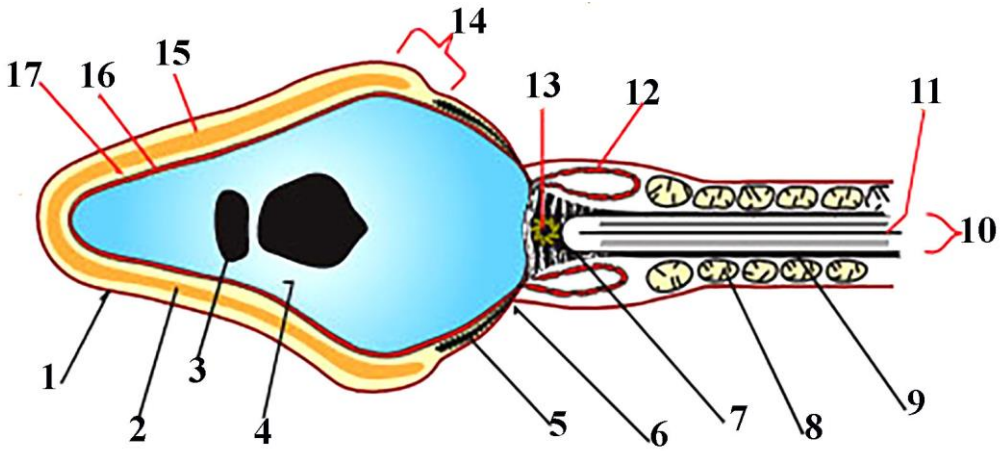
Şəkil 9.4. Рисунок 9.4. Figure 9.4.
The different stages of spermatogenesis

1. dark type A spermatogonia
2. pale type A spermatogonia
3. spermatogonial division
4. nucleus of sustentacular or Sertoli cells
5. cytoplasm of sustentacular or Sertoli cells
6. primary spermatocytes
7. spermatids
8. maturing spermatids
9. spermatozoa (mature sperm)



Şəkil 9.5. **Рисунок 9.5.** **Figure 9.5.**
 Schematic structure of the spermatozoa.

- 1. plasmalemma,
- 2. acrosome
- 3. nucleus
- 4. neck
- 5. Mitochondrion
- 6. Annulus
- 7. axoneme
- 8. head
- 9. Middle piece
- 10. Principal piece
- 11. End piece

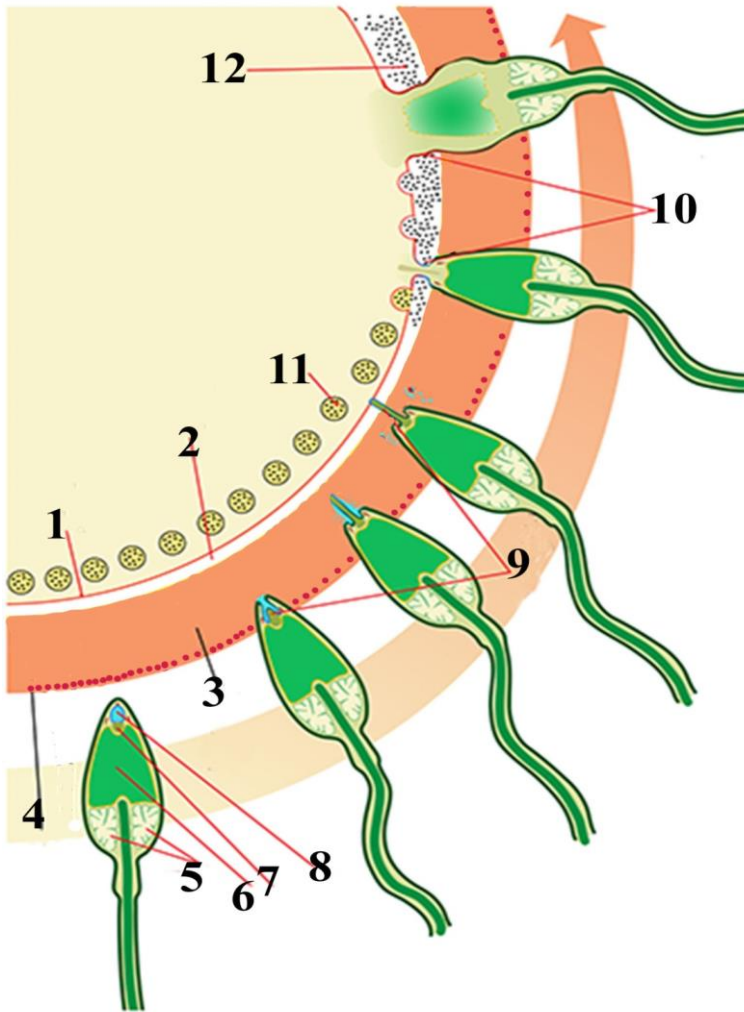


Şəkil 9.6. Рисунок 9.6. Figure 9.6.
Schematic representation of the head and the intermediate part of the spermatozoon.

1. plasma membrane, 2. acrosome, 3. nuclear vacuole, 4. nucleus, 5. post akrosomal qışa, 6. arxa dairə, 7. Connecting region, 8. mitochondria 9. Outer dense fibers, 10. axonema, 11. Central paire, 12. Residius of nuclear envelope, 13. centriole 14. ekvatorial seqment, 15. Outer membrane of acrosome 16. Nuclear membrane, 17. Subaxrosomal region

Mayalanma. İmplantasiya. Ziqotanın bölünməsi.

10



Şəkil 10.1.

Рисунок 10.1.

Figure 10.1.

Schematic picture of acrosomal reactions

1. plasma membrane of oocyte – oolemma
2. perivitelline space
3. zona pellucida
4. receptor proteins

5. mitochondria
6. nucleus
7. actin filaments
8. acrosomal granules
9. acrosomal reactions
10. perforation of oolemma
11. cortical granules
12. content of cortical granules



Şəkil 10.2.

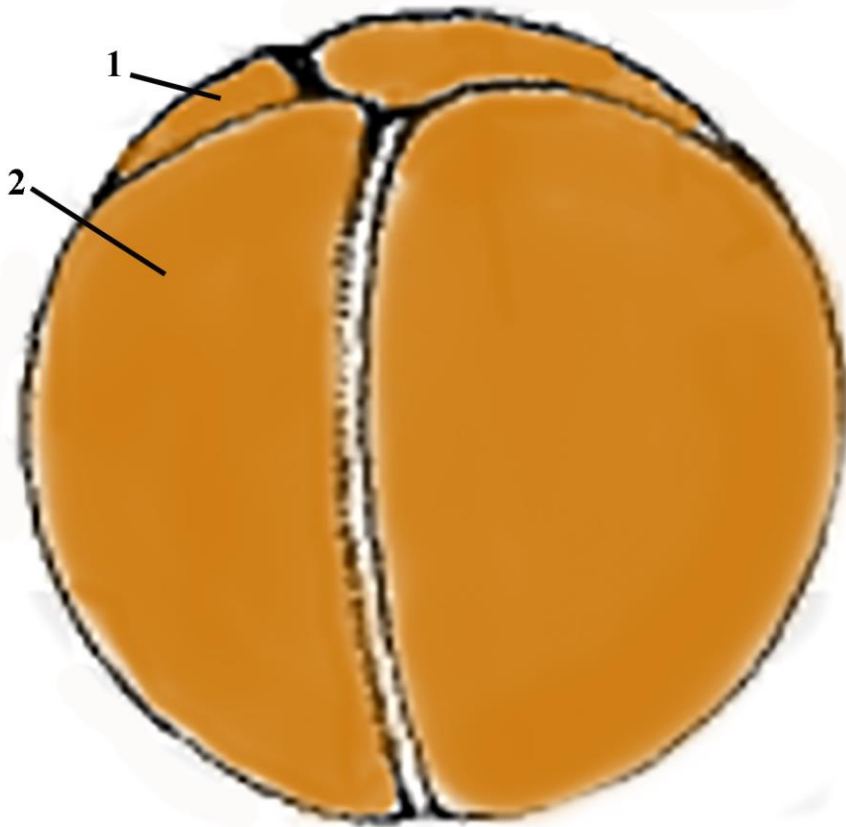
Рисунок 10.2.

Figure 10.2.

The microscopic picture of syncaryon in a fertilized horse ascaride oocyte.

Stain: ferrous hematoxylin.

1. fusion of male and female pronuclei.



Şəkil 10.3.

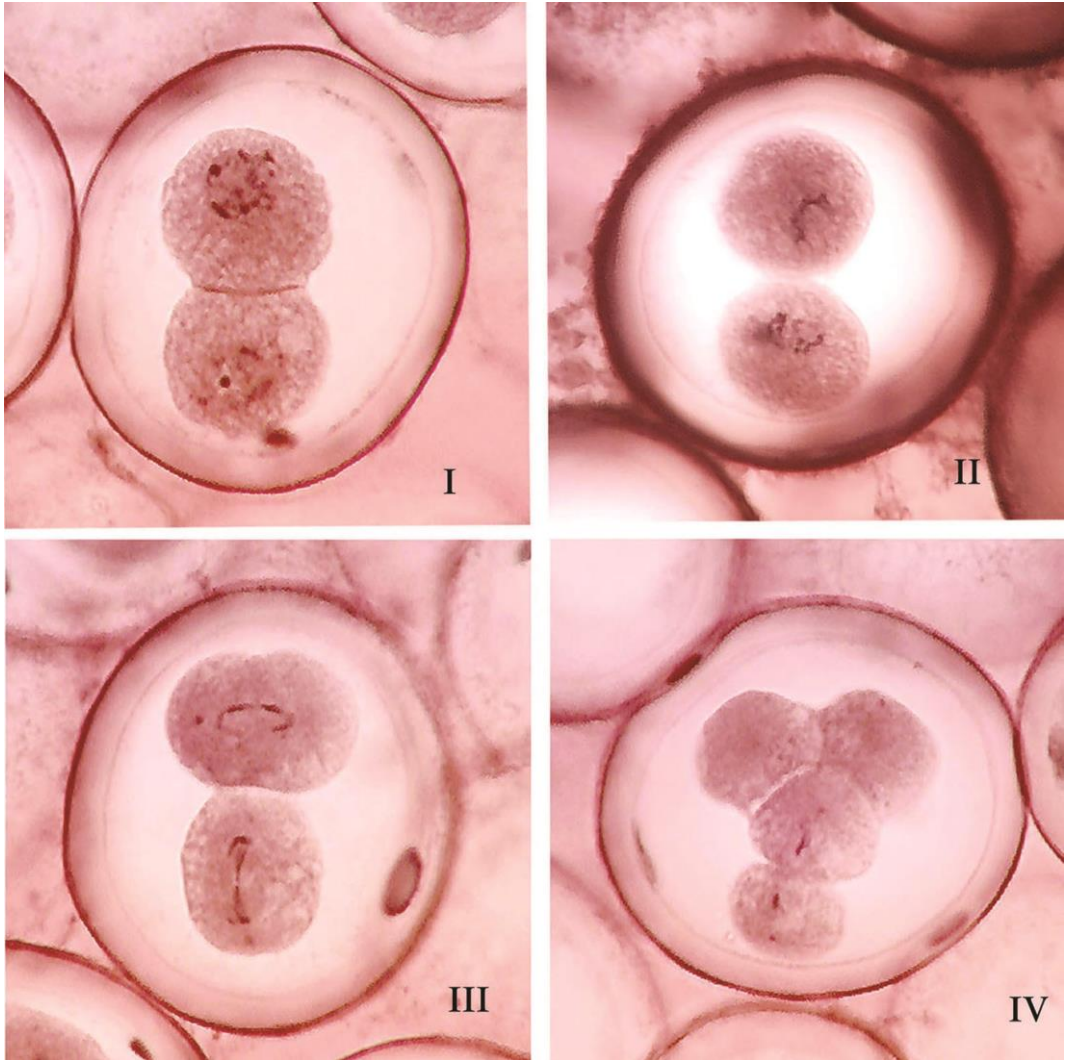
Рисунок 10.3.

Figure 10.3.

Complete non-equal cleavage of frog zygote.

Stain: hematoxylin-picrofuchsine.

1. macromers (large blastomeres)
2. micromers (small blastomeres)



Şəkil 10.4.

Рисунок 10.4.

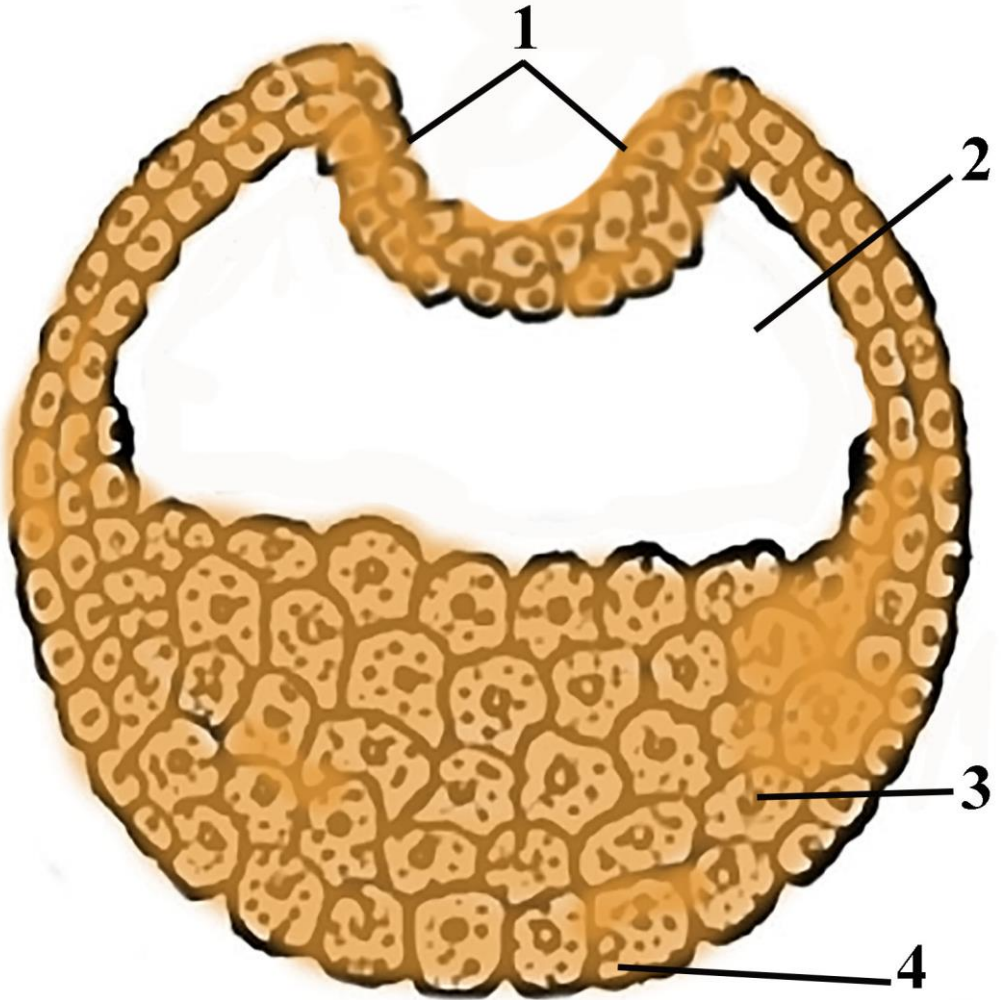
Figure 10.4.

Complete equal cleavage of horse ascaride zygote.

Stain: ferrous hematoxylin.

I formation of groove of division in telophase II formed 2 blastomeres

III 2 blastomeres in metaphase IV 4 blastomeres stage due
bilateral division.



Şəkil 11.1.

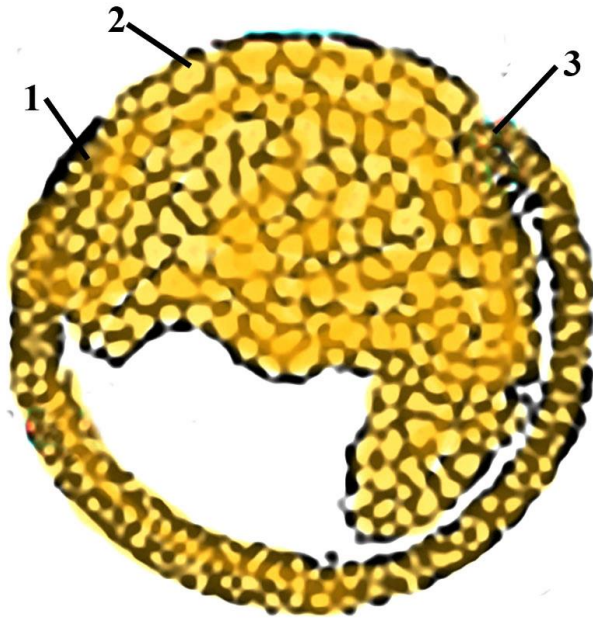
Рисунок 11.1.

Figure 11.1.

Blastula of frog. Stain: hematoxylin-picrofuchsine.

- 1. roof of blastula;
- 2. blastocoel;

3. blastomere;
4. bottom of the blastula.



Şəkil 11.2.

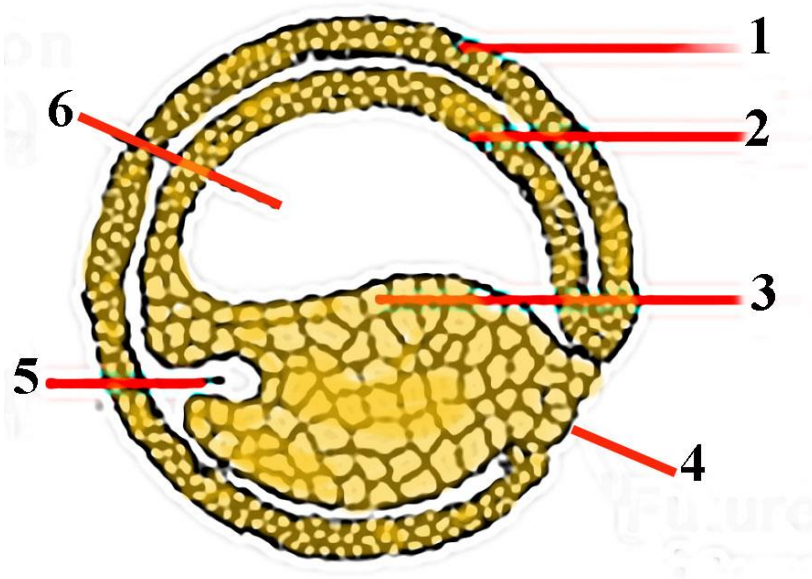
Рисунок 11.2.

Figure 11.2.

Gastrula of frog.

Stain: hematoxylin-picrofuchsine.

1. ventral lip of blastopore
2. yolk sac core
3. dorsal lip of blastopore



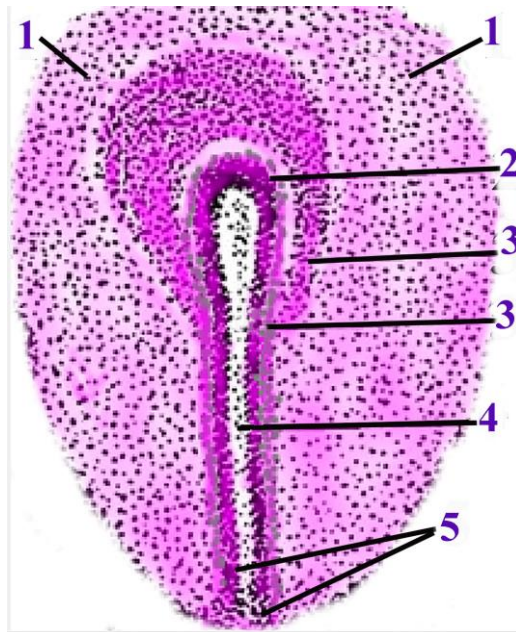
Şəkil 11.3

Рисунок 11.3.

Figure 11.3.

Late stage of frogs gastrula

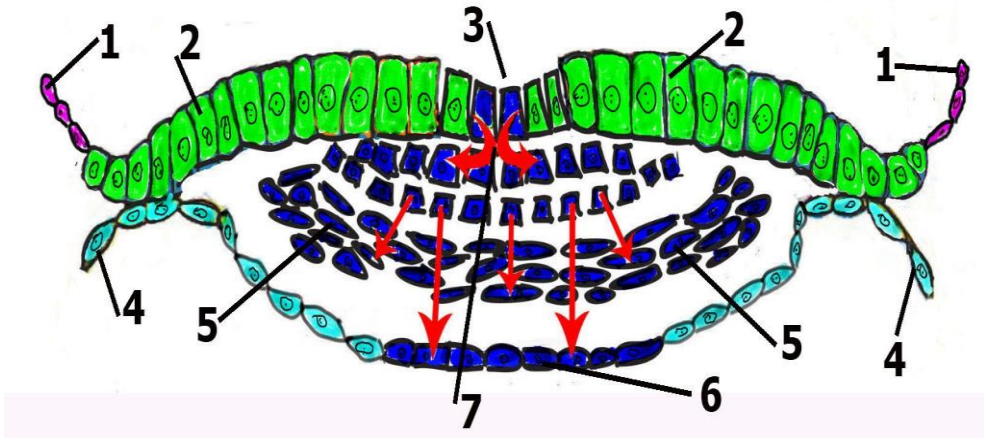
1. ectoderm
2. mesoderm
3. endoderm
4. future anus
5. blastocoel
6. future gut (archenteron)



Şəkil 11.4. Рисунок 11.4. Figure 11.4.
General view of primitive streak and surrounding structures.

Stain: hematoxylin-eosin.

1. Light zone
2. primitive (Hensen's) node
3. germ of mesoderm
4. primitive pit
5. primitive streak



Şəkil 11.5.

Рисунок 11.5.

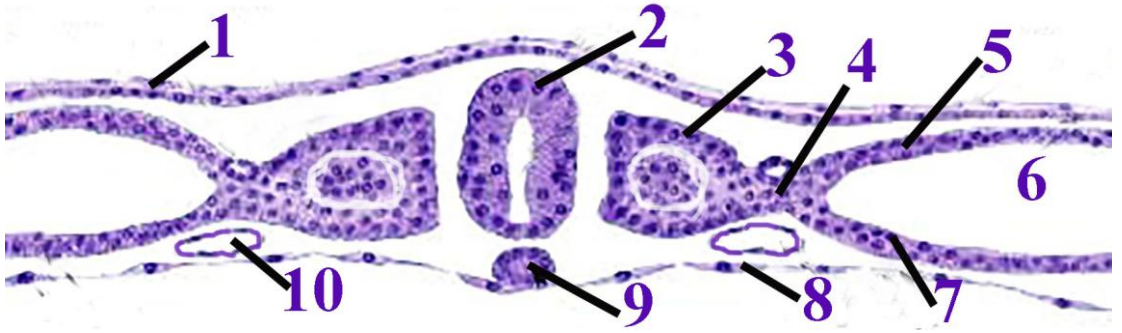
Figure 11.5.

Schematic representation the formation of embryonic layers

1. amnioblast
2. epiblast
3. primitive streak
4. ectoderm surrounding of yolk sac
5. mesoderm
6. last endoderm
7. migrated cells

Rüşeymin ox orqanlarının formalaşması. Rüşeymxarici orqanlar.

12



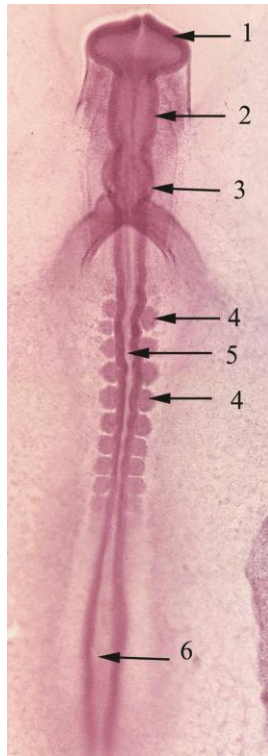
Şəkil 12.1.

Рисунок 12.1.

Figure 12.1.

**Microscopic picture of transitional section of axial organs of chicken embryo.
Stain: ferric hematoxylin.**

1. dermal ectoderm;
2. neural tube;
3. somite;
4. intermediate mesoderm (nephrotom);
5. parietal mesoderm layer (somatopleura);
6. coelom (secondary body space).
7. visceral mesoderm layer (splachnopleura);
8. endoderm;
9. notochord;
10. blood vessels



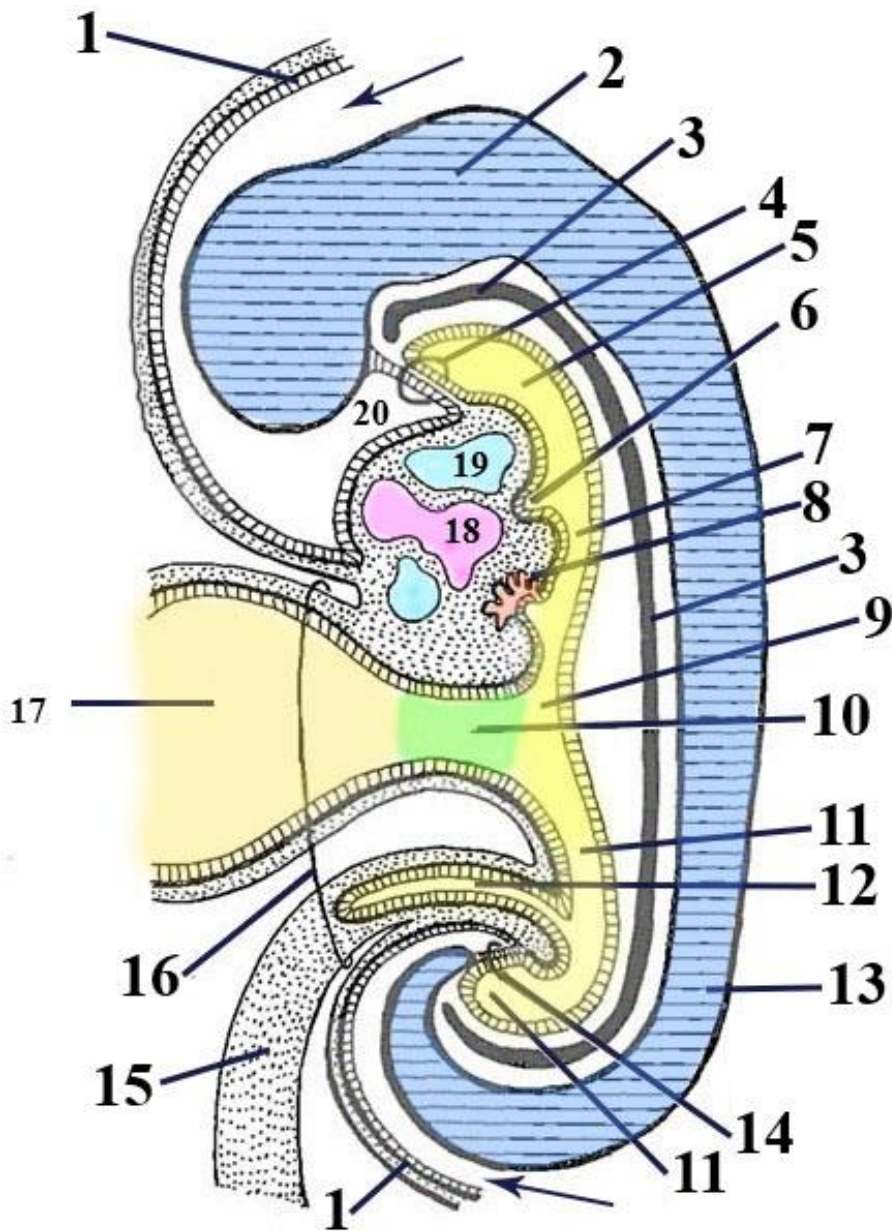
Şəkil 12.2.

Рисунок 12.2.

Figure 12.2.

Total slide of chicken embryo after 31 hours of incubation. Stain: hematoxylin-eosin.

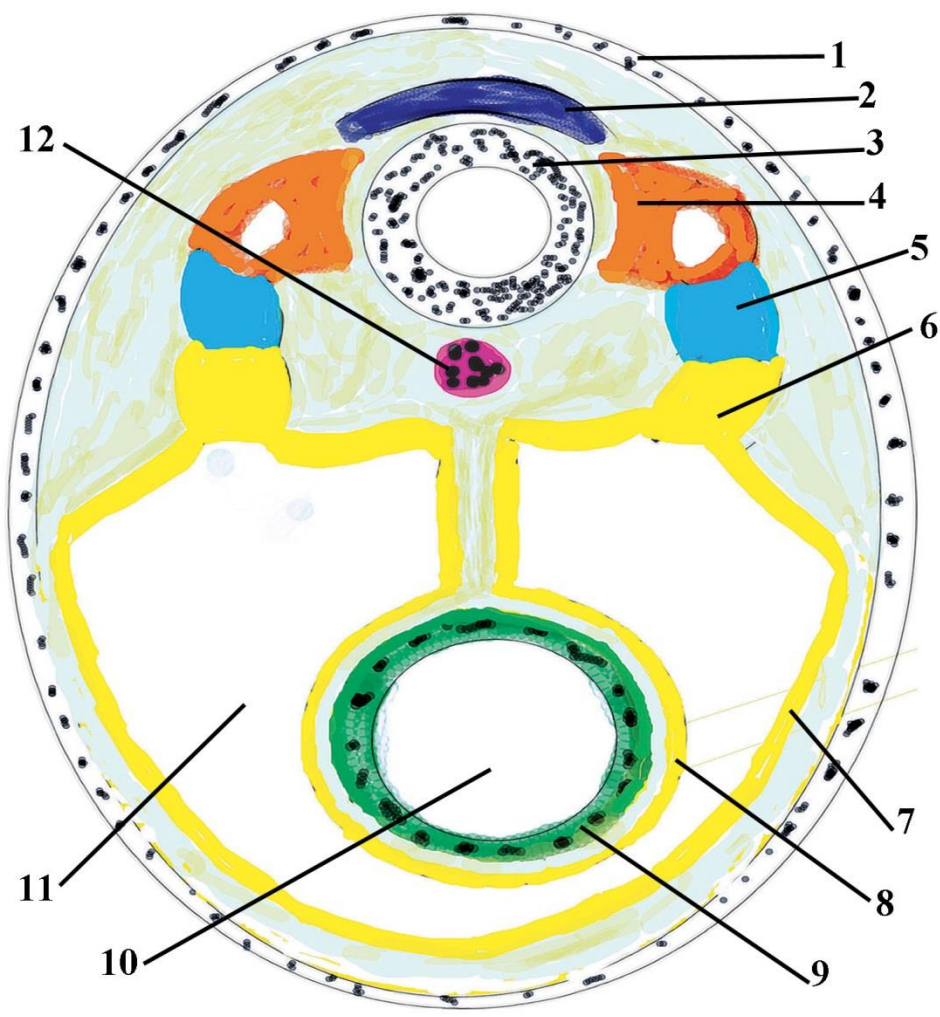
1. proencephalon
2. mesencephalon
3. rhombencephalon
4. somites
5. neural tube
6. remnant of primitive streak



Şəkil 12.3. Рисунок 12.3. Figure 12.3.
Lateral view of a human embryo at 28 days.

- 1 amnion
- 2 cranial part of neural tube
- 3 notochord

- 4 oropharyngeal membrane
- 5 gut tube
- 6 respiratory diverticulum
- 7 foregut
- 8 liver bud
- 9 midgut
- 10 yolk sac
- 11 hindgut
- 12 allantois
- 13 caudal part of neural tube
- 14 cloacal membrane
- 15 connecting stalk
- 16 umbilical ring
- 17 yolk sac
- 18 heart bulge
- 19 source of pericardium
- 20 stomadeum



Şəkil 12.4.

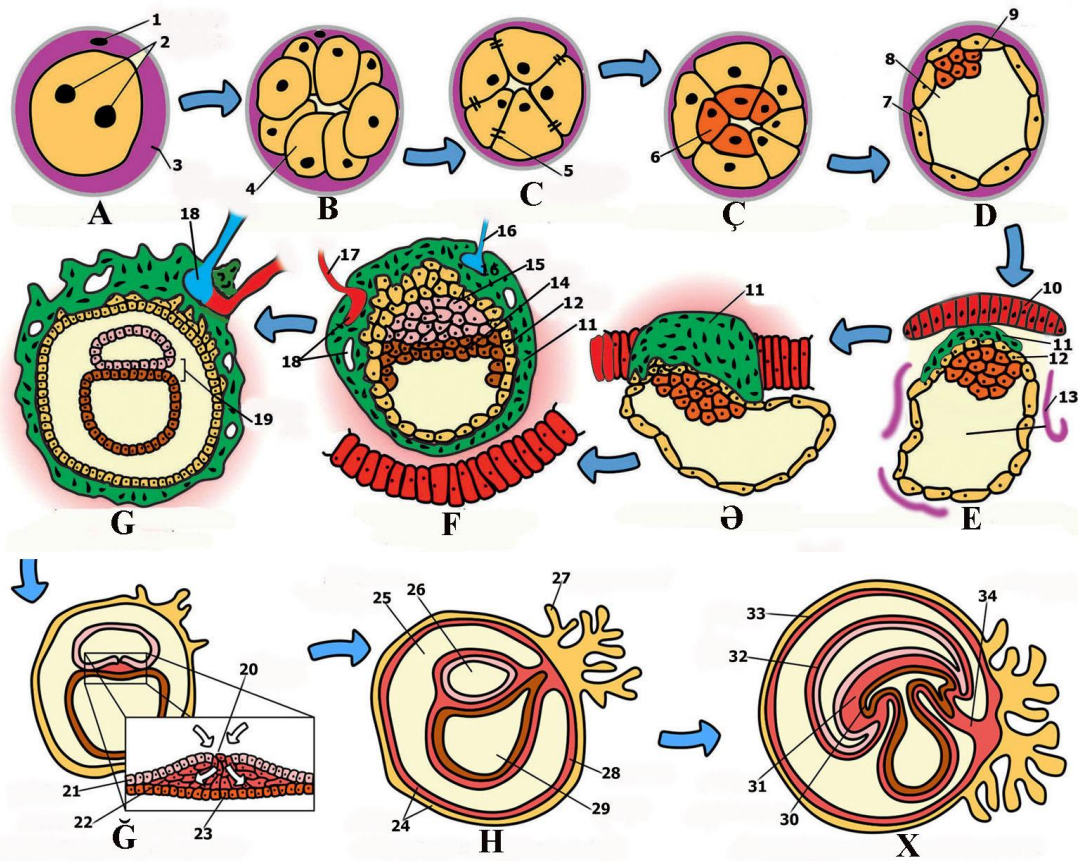
Рисунок 12.4.

Figure 12.4.

Schematic picture of transverse section of axial organs

- 1. dermal ectoderm
- 2. neural crest cell
- 3. neural tube
- 4. somite
- 5. intermediate mesoderm
- 6. lateral mesoderm
- 7. parietal mesoderm layer (somatopleura)
- 8. visceral mesoderm layer (splachnopleura)

9. epithelial lining of primary gut
10. lumen of primary gut
11. coelom (secondary body space)
12. notochord



Şəkil 12.5.

Рисунок 12.5.

Figure 12.5.

Schematic view of development stage in human embryo

A. fertilization; B. cleavage; C1. formation tight junction; C2. Differentiation; D. formation blastocoel cavity; E1. adhesion stage; E2. Implantation; F. differentiation inner and outer cellular mass; G1. formation of embryonic disk; G2. formation of mesoderm; H. developing mesoderm; X. enlarged amniotic cavity.

- 1. polar bodies**
- 2. pronucleus**
- 3. zona pellucida**
- 4. blastomere**
- 5. tight junction**
- 6. inner cell**
- 7. trophoblast**
- 8. blastocyst cavity**
- 9. inner cell mass – embryoblast**
- 10. endometrium**
- 11. syncytiotrophoblast**
- 12. cytotrophoblast**
- 13. degenerating zona pellucida**
- 14. hypoblast**
- 15. epiblast**
- 16. uterus vein**
- 17. uterus arteries**
- 18. space for circulating maternal blood**
- 19. embryonic disk**
- 20. primitive streak**
- 21. ectoderm**

22.mesoderm

23.endoderm

24.chorion

25.extraembryonal coelom

26.amniotic cavity

27.villi

28.extraembryonal mesoderm

29.yolk sac

Referat için

Referat için

Referat için

Referat için

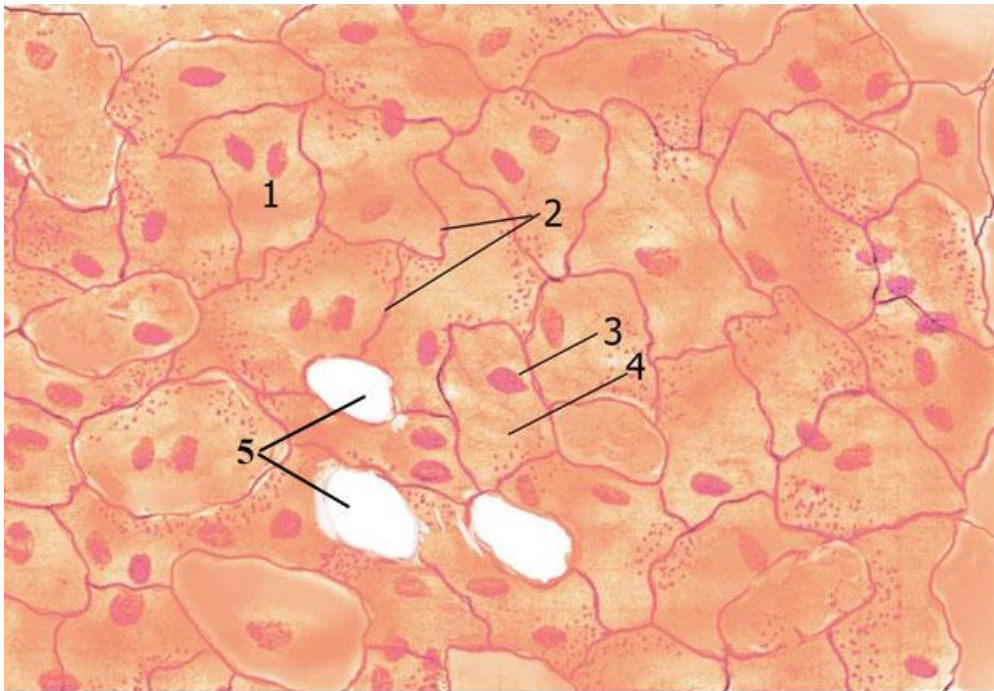
Referat için

II diaqnostikum.

13

Birqatlı epitel. Çoxqatlı epitel. Vəzi epiteli.

14



Şəkil 14.1.

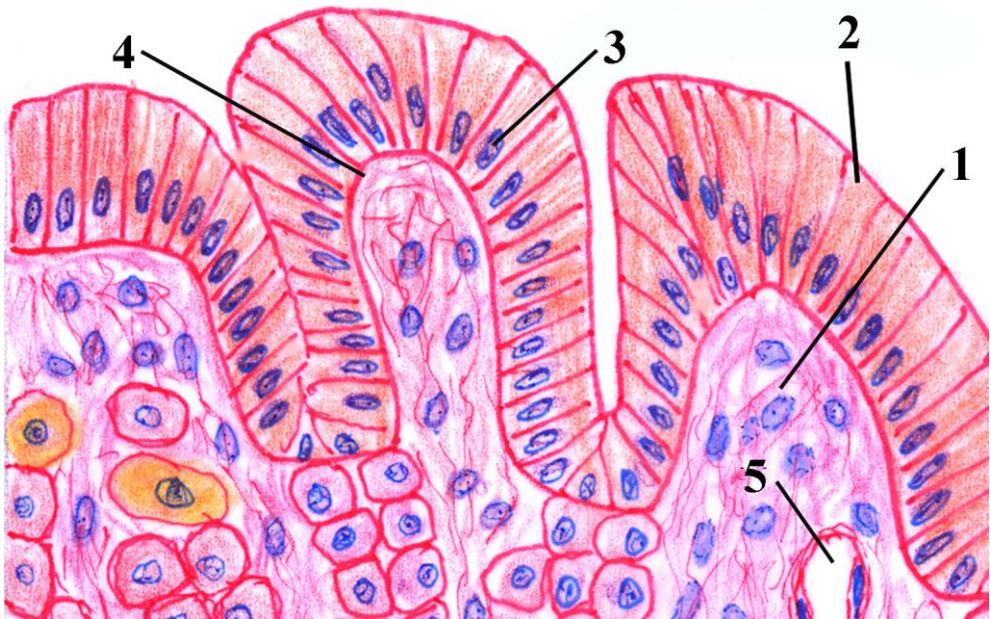
Рисунок 14.1.

Figure 14.1.

Simple squamous epithelium (mesothelium) of omentum.

Stain: silvering.

1. epithelial cells
2. cell border
3. nucleus.
4. cytoplasm
5. stomata



Şəkil 14.2.

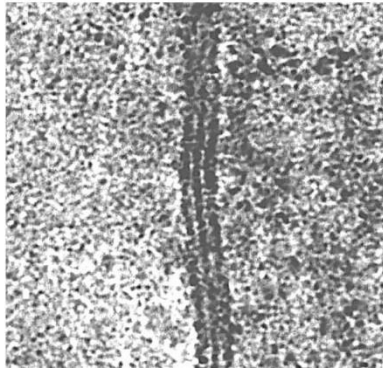
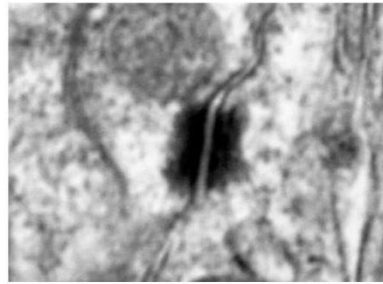
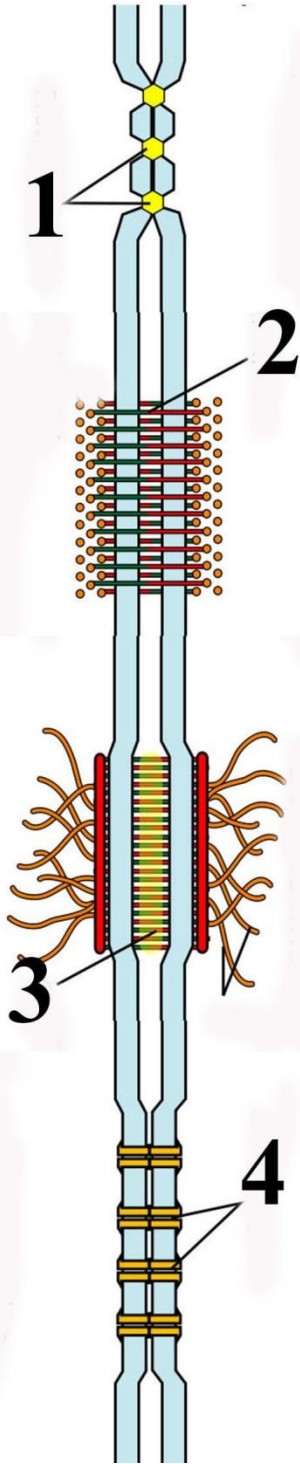
Рисунок 14.2.

Figure 14.2.

Schematic drawing of histological structure of the simple columnar epithelium.

Stain: hematoxylin-eosin.

1. Lamina propria
2. Cytoplasm of columnar epithelial cell
3. Nucleus of columnar epithelial cell
4. Basement membrane
5. Blood vessels



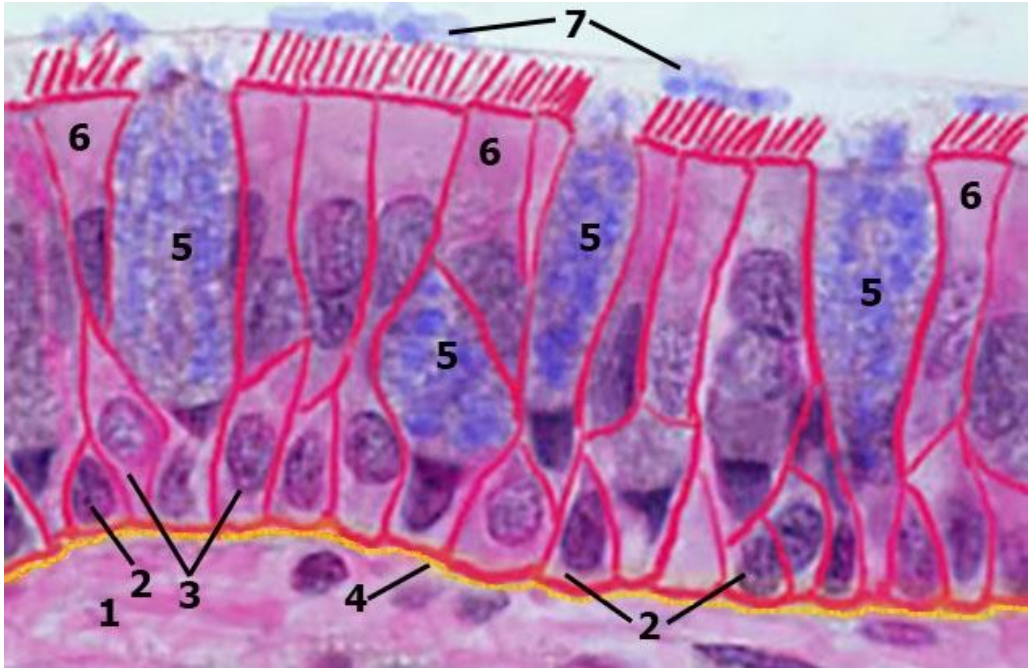
Şəkil 14.3.

Рисунок 14.3.

Figure 14.3.

Intercellular junction

1. zonula occludent 2. zonula adherens 3. desmosome 4.
communicating junction (nexus)



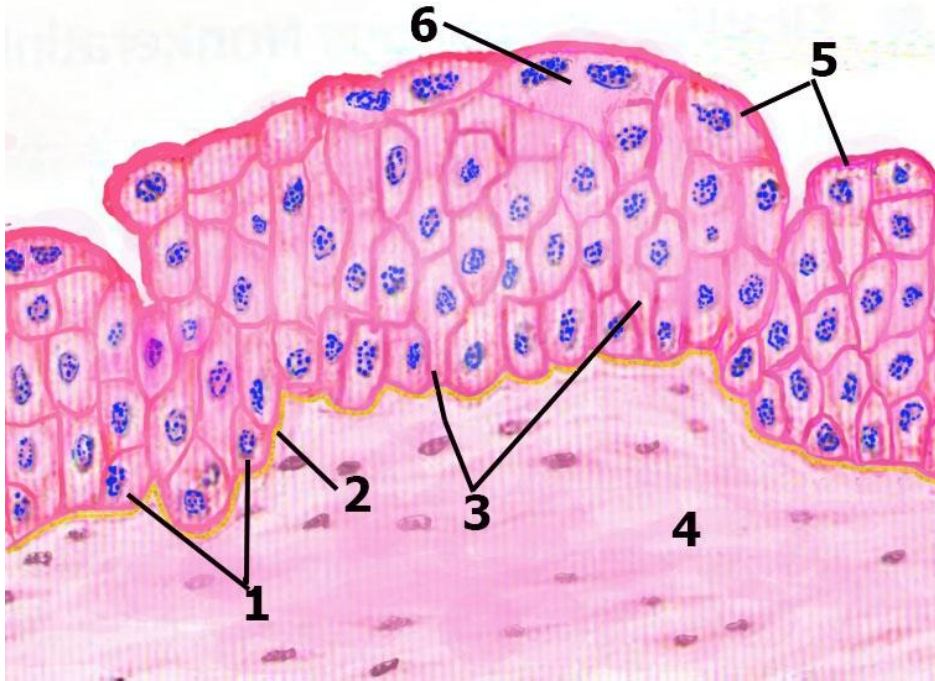
Şəkil 14.4.

Рисунок 14.4.

Figure 14.4.

Pseudostratified columnar ciliated epithelium in the mucosa of trachea

- 1- loose connective tissue
- 2- short intercalated epithelial cells
- 3- long intercalated epithelial cells
- 4- basal membrane
- 5- goblet cell
- 6- ciliated cell
- 7- mukus



Şəkil 14.5.

Рисунок 14.5.

Figure 14.5.

Transitional epithelium (Urothelium) in the unstretched urinary bladder

1 basal layer

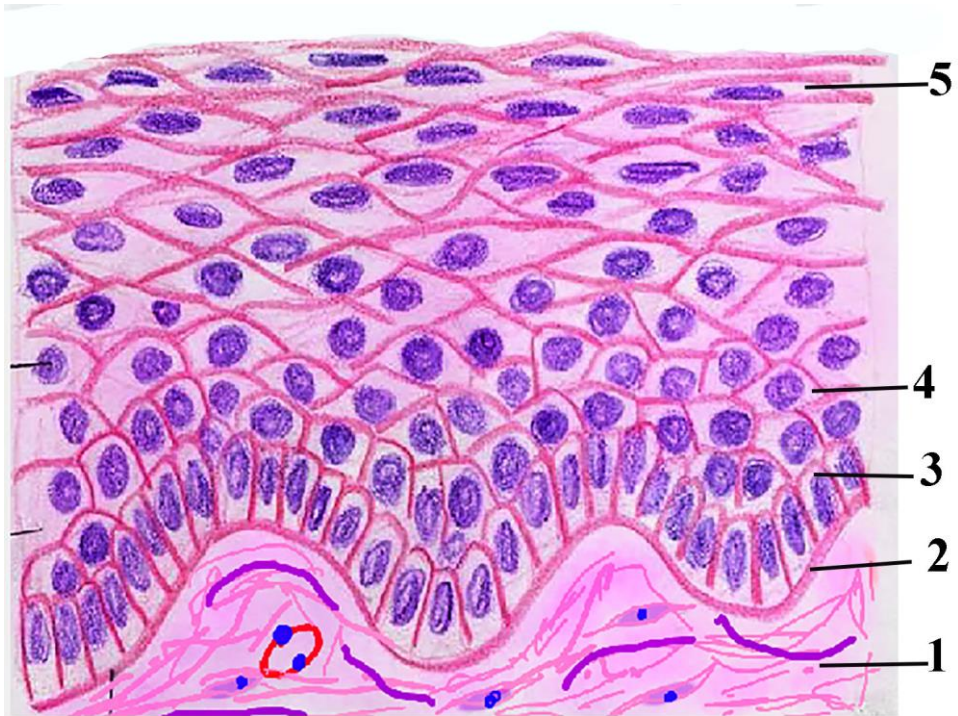
2-basal membrane

3-intermediate layer

4-Lamina Propria

5-Superficial layer

6-binuclear cells



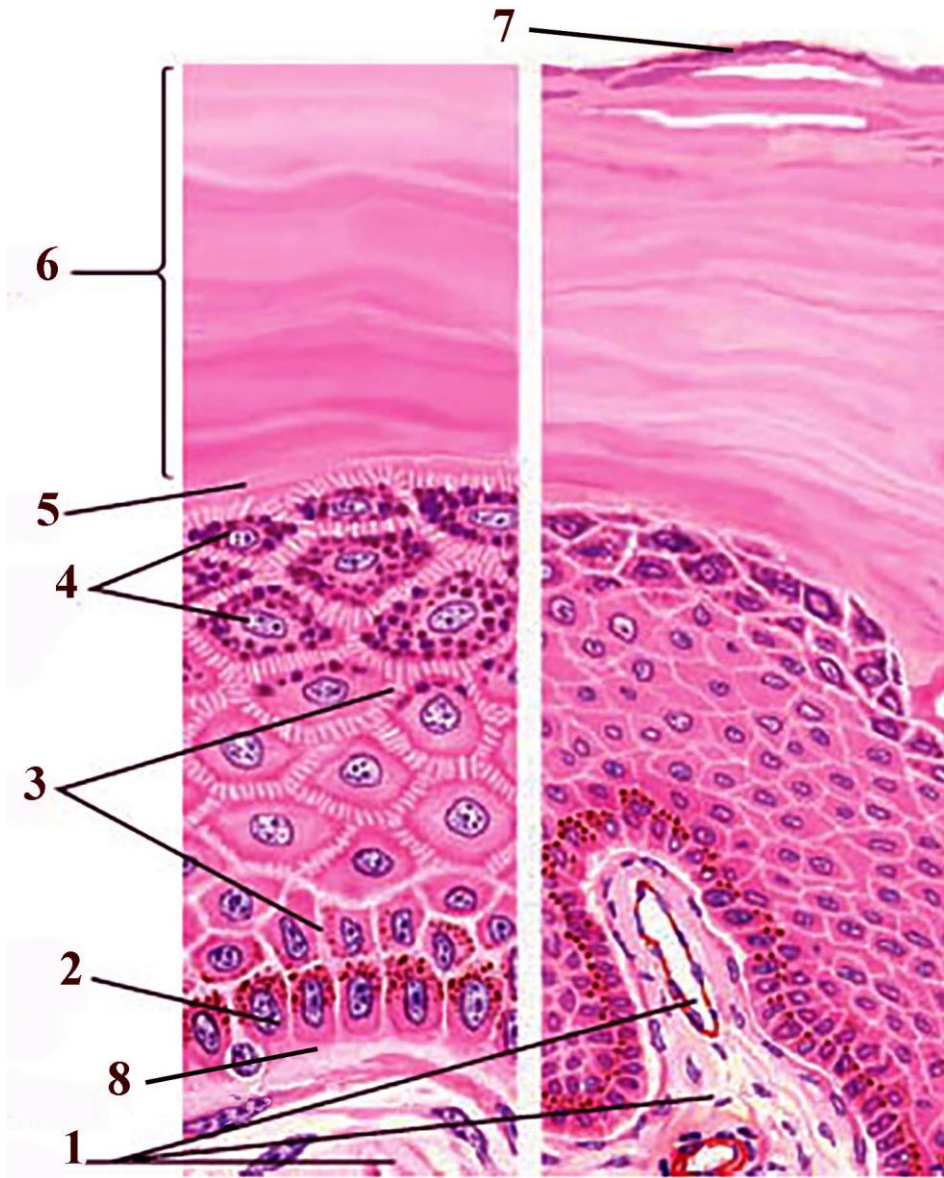
Şəkil 14.6.

Рисунок 14.6.

Figure 14.6.

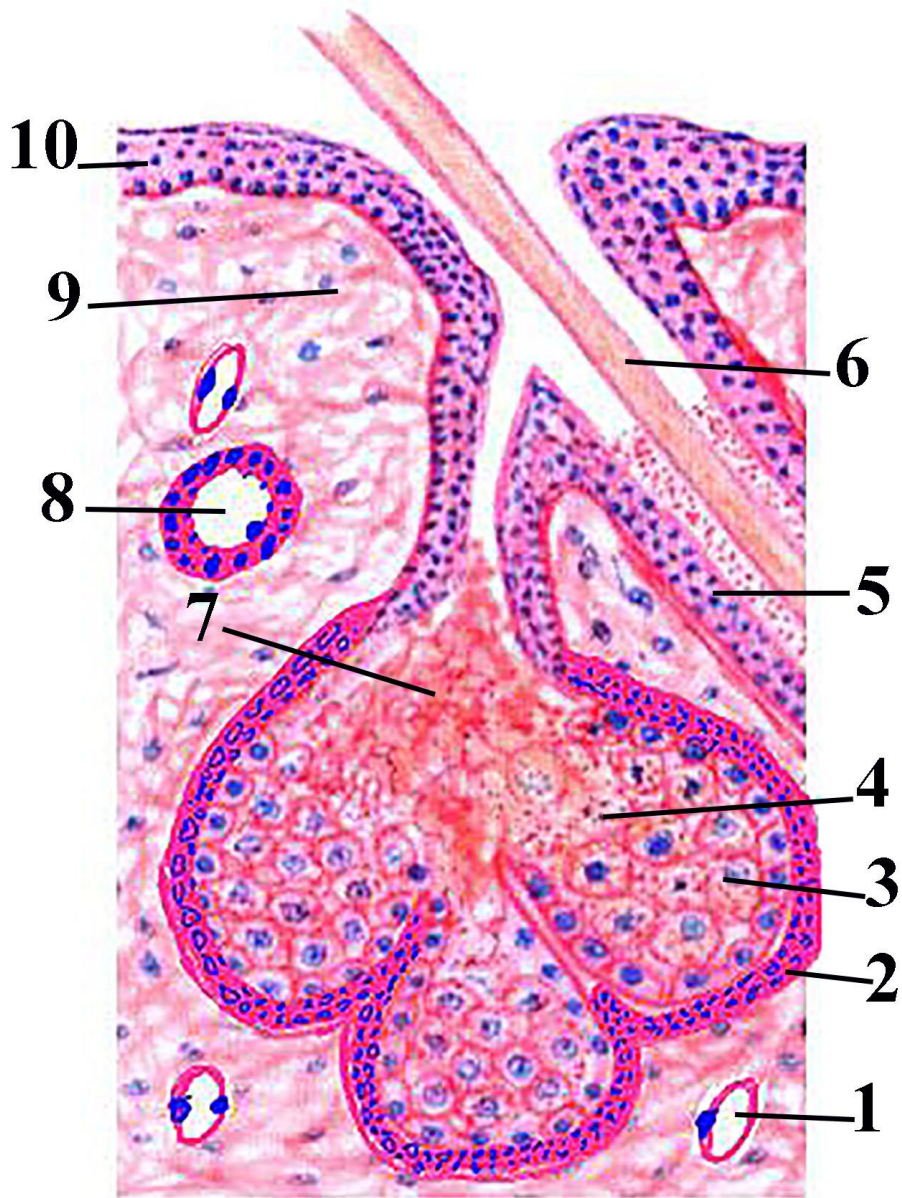
Schematic picture of stratified squamous nonkeratinized epithelium

- 1- connective tissue elements
- 2- Basement membrane
- 3- Basal layer
- 4- Intermediate layer
- 5- Superficial layer



Şəkil 14.7. Рисунок 14.7. Figure 14.7.
Microscopic structure of stratified squamous keratinized epithelium (skin of finger)
1-Dermal papilla
2- stratum basale
3 Stratum spinosum
4- Stratum granulosum

- 5- Stratum lucidum**
- 6- Stratum corneum**
- 7- Stratum corneum cell which sloughed off.**
- 8- Basement membrane**

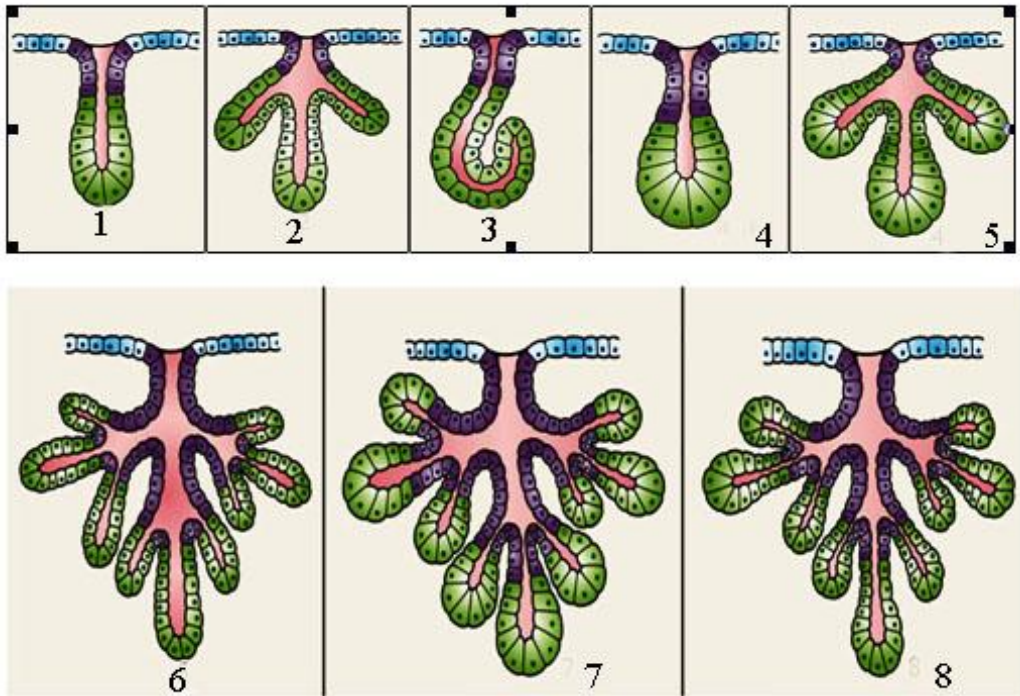


Şəkil 14.8. Рисунок 14.8. Figure 14.8.
Histological slide of sebaceous gland and surrounding structure.

1 blood vessels

1 stem cells resting on the basement membrane

- 2 sebocytes**
- 3 Degenerating sebocytes**
- 4 External root sheath**
- 5 Cortex of hair shaft**
- 6 Product of sebaceous gland – sebum**
- 7 Duct of sweat gland**
- 8 Connective tissue elements**
- 9 epidermis**



Şəkil 14.9. Рисунок 14.9. Figure 14.9.

Classification of epithelial glands

10 simple tubular gland

2-simple branched tubular gland

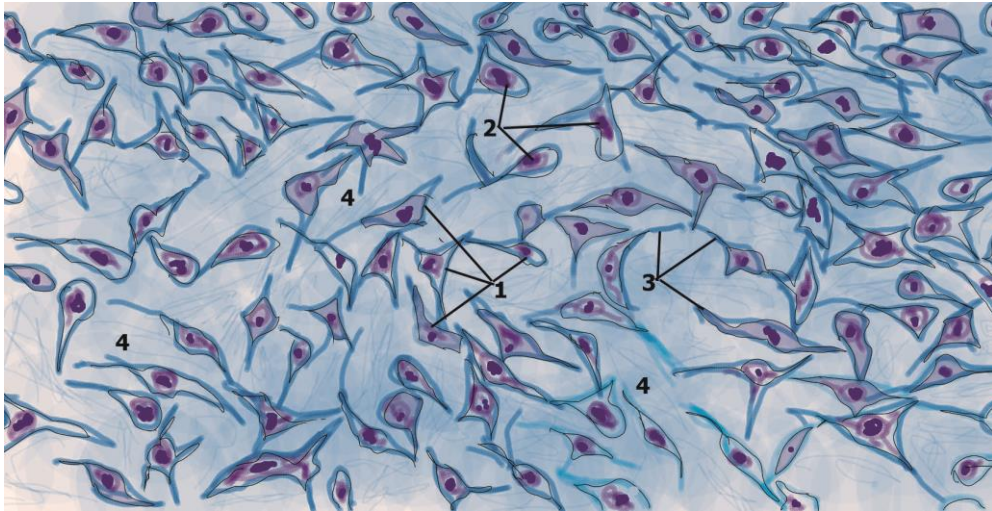
3 Simple coiled tubular gland

3a Simple acinar (alveolar) gland

4 Simple branched acinar (alveolar) gland

Mezenxim. Mezenxim törəmələri. Qan. Limfa.

15

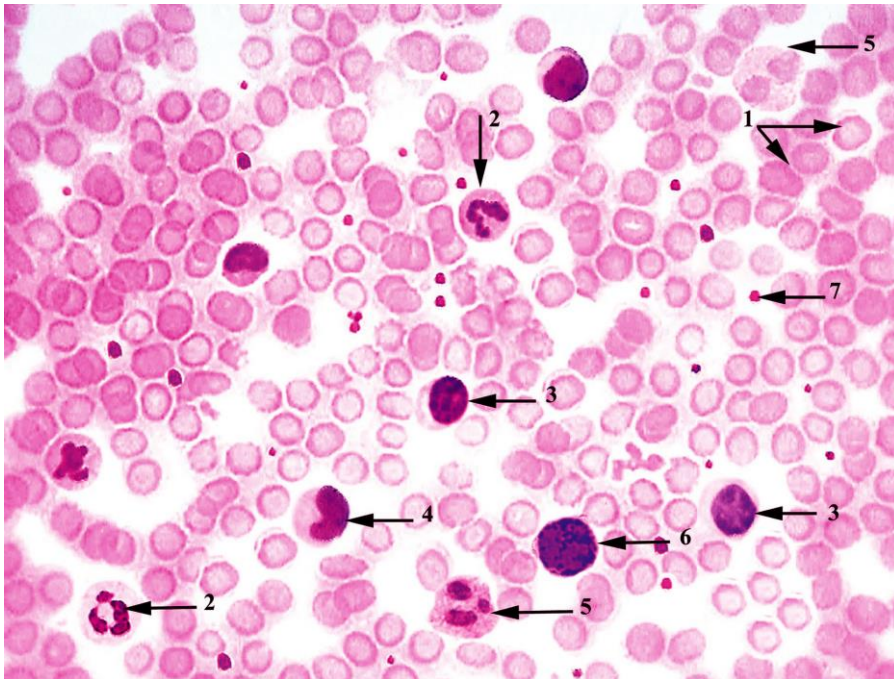


Şəkil 15.1. Рисунок 15.1. Figure 15.1.

Mesenchyme - embryonic connective tissue in chicken embryo.

Stain: hematoxyline –eosin.

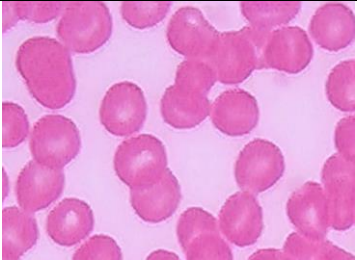
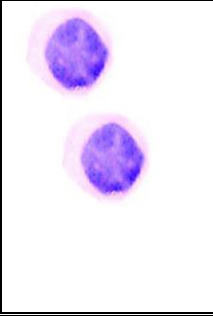
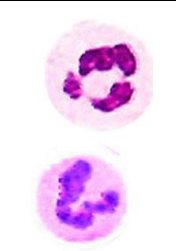
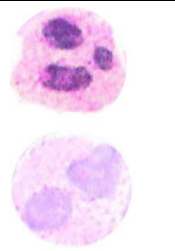
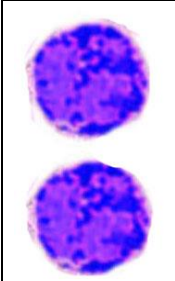
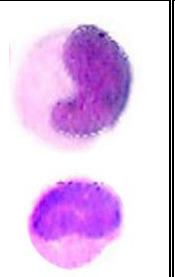

1. mesenchymal cells 2. Nuclei of mesenchymal cells 3. Processes of mesenchymal cells 4. Ground substance



Şəkil 15.2. Рисунок 15.2. Figure 15.2.

Smear of human blood. Reconstruction. Stain Giemsa.

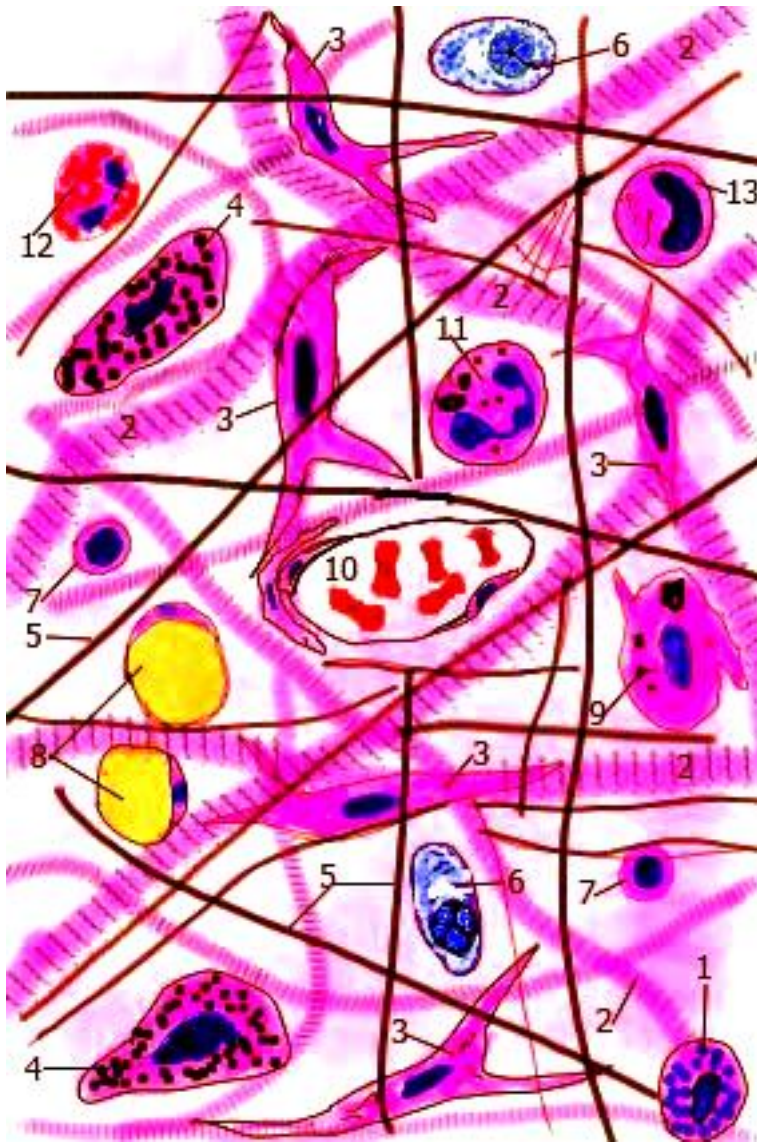
1. erythrocytes (red blood cells)
2. neutrophil
3. lymphocyte
4. monocyte
5. eosinophil
6. basophil
7. platelet (thrombocyte).

							
Cell type	Erythrocyte	Lymphocyte	Neutrophil	Eosinophil	Basophil	Monocyte	Platelet
Size	6.5 – 7.7 mkm	6-15 mkm	14-16 mkm	12-17 mkm	14-16 mkm	16-20 mkm	1.5-3.5 mkm
Number per litre	$3.9 - 6.5 \times 10^{12}$	$0-0.1 \times 10^9$	$2-7.5 \times 10^9$	$1.3-3.5 \times 10^9$	$0-0.44 \times 10^9$	$0.2-0.8 \times 10^9$	$150-400 \times 10^9$
Approximate percentage	-	20-50%	40-75%	1-6%	<1%	2-10%	-
Duration of development	5-7 days	1-2 days	6-9 days	6-9 days	3-7 days	2-3 day	4-5 days
Lifespan of mature cells	120 days		From 6 hour till some days	8-12 days		From 1 month till some year	8-121 days

Şəkil 15.3.

Рисунок 15.3.

Figure 15.3.



Şəkil 16.1.

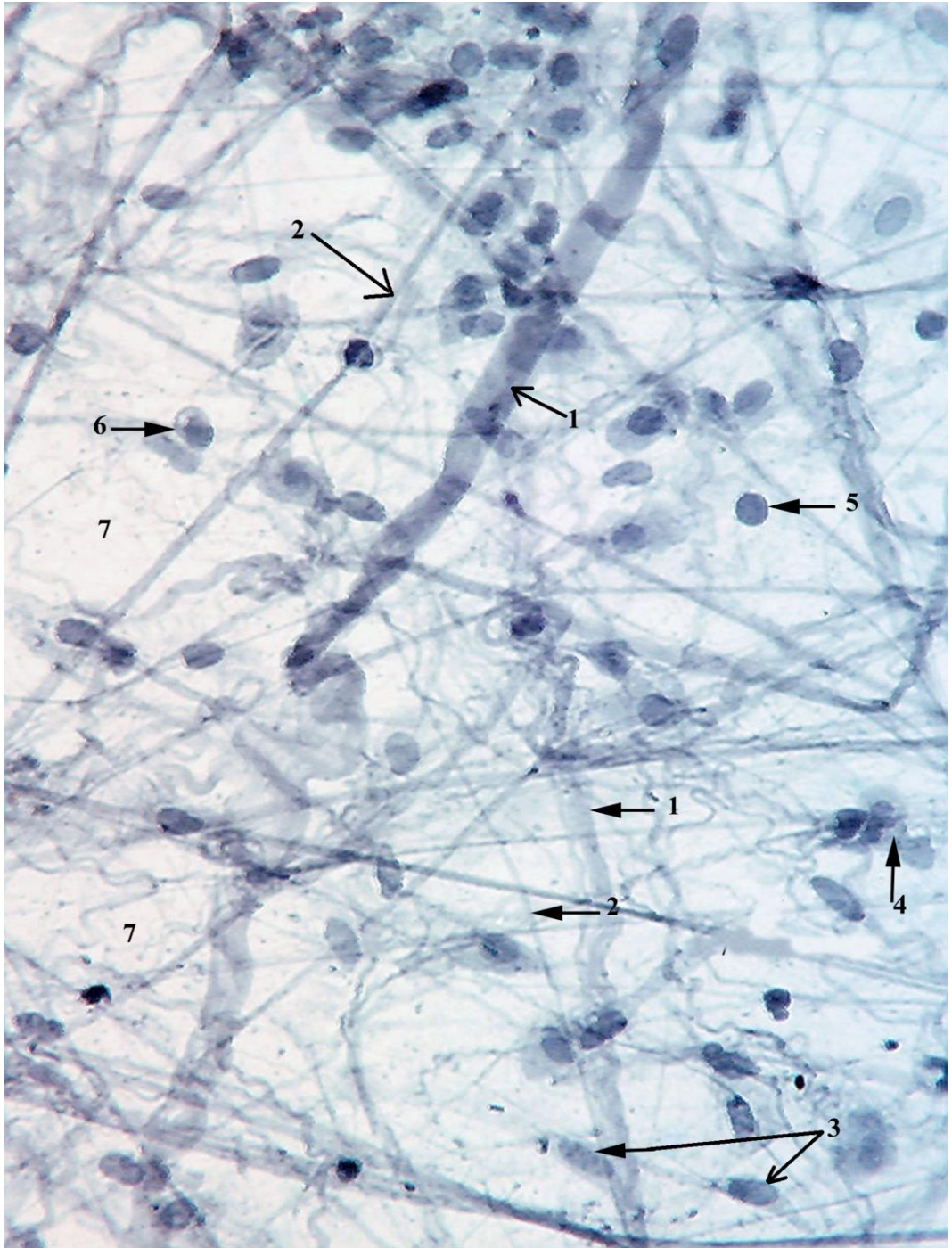
Рисунок 16.1.

Figure 16.1.

Histological picture of loose connective tissue.

Stain: hematoxylin-eosin.

1. basophils
2. collagen fibers
3. fibroblasts
4. mast cell
5. elastic fibers
6. plasma cell
7. lymphocyte
8. adipocytes
9. macrophage
10. capillaries
11. neutrophils
12. eosinophils
13. monocytes



Şəkil 16.2.

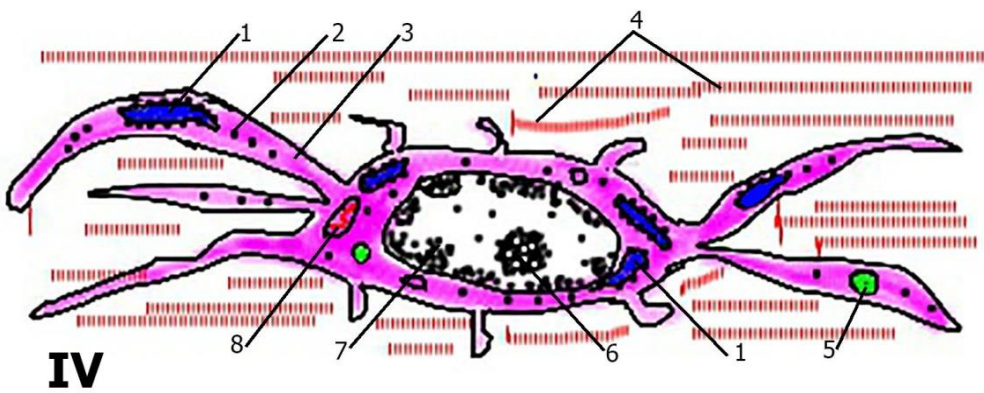
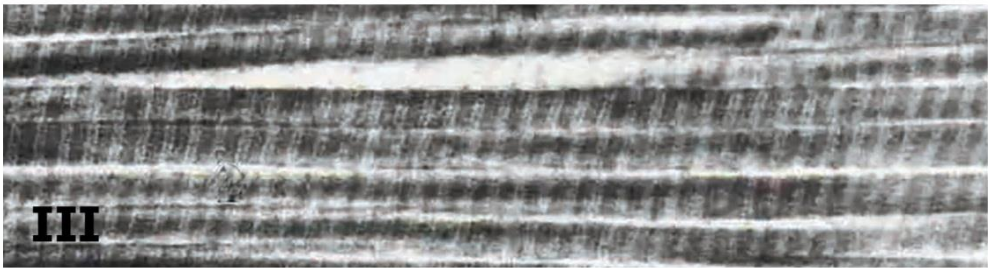
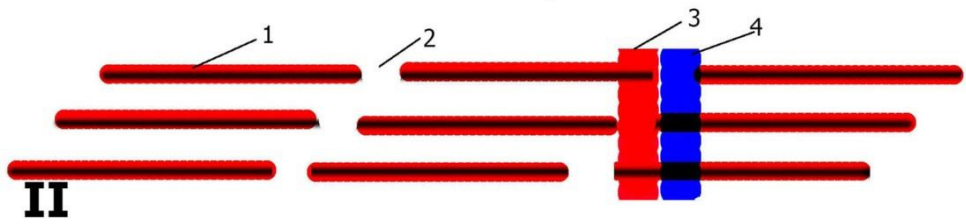
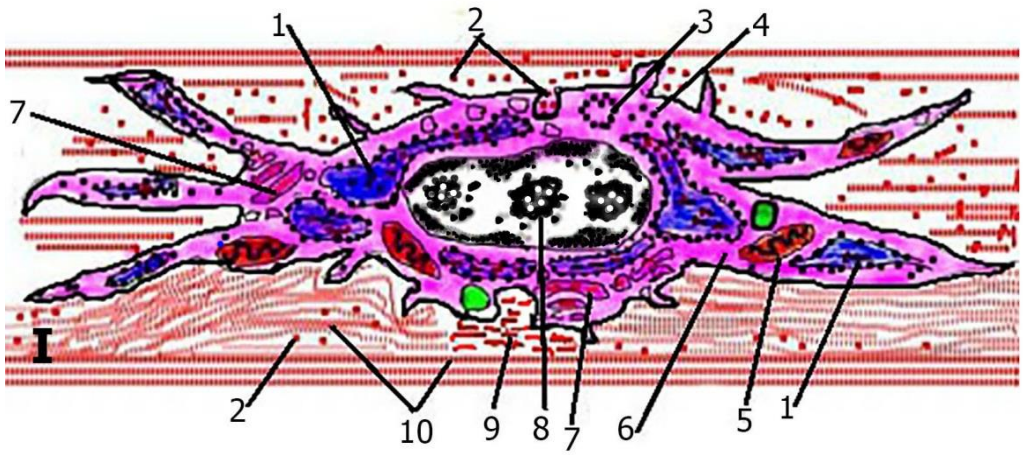
Рисунок 16.2.

Figure 16.2.

Histological slide of loose connective tissue.

Stain: ferrous hematoxylin

1. bundles of collagen fibers
2. elastic fibers
3. fibrocyte
4. macrophage
5. lymphocyte
6. plasma cell
7. ground substance



Şəkil 16.3.

Рисунок 16.3.

Figure 16.3.

I Fibroblast and surrounding structures.

- 1 rough endoplasmic reticulum
- 2 ground substance
- 3 polyribosomes
- 4 ribosomes
- 5 mitochondrion
- 6 cytosol
- 7 Golgi apparatus
- 8 nucleolus
- 9 tropocollagen molecules
- 10 collagen fibres

II interaction between collagen molecules

- 1 collagen molecules
- 2 hold region between two collagen molecules
- 3 light region
- 4 Dark overlap region

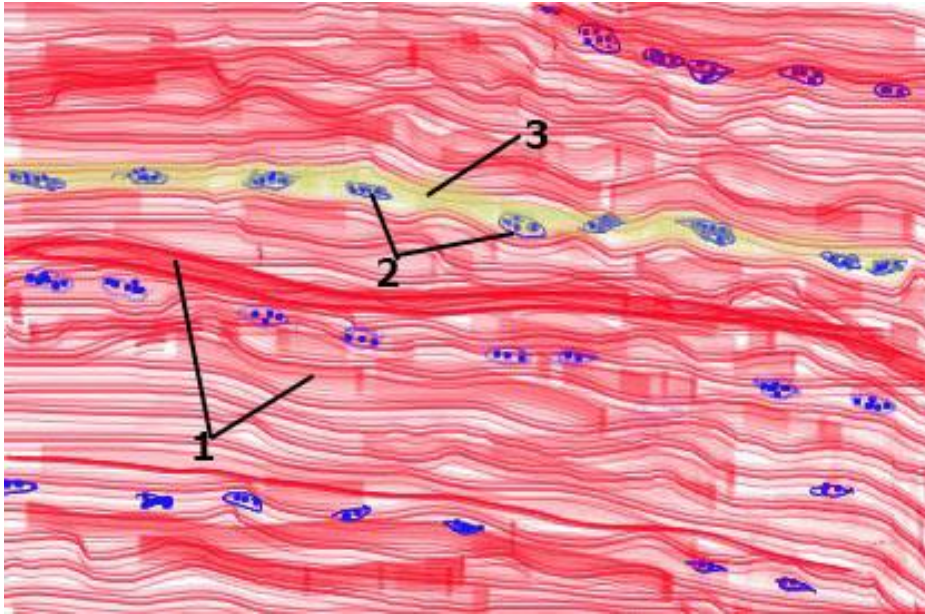
III electron microscopic structure of collagen fibers

IV Fibrocyte and surrounding structures

- 1 rough endoplasmic reticulum
- 2 ribosomes
- 3 cytosole
- 4 collagen fibres
5. lysosome
6. nucleolus
- 7 nucleus
- 8 mitochondrion

Sıx lifli və spesifik xassəli birləşdirici toxumalar.

17



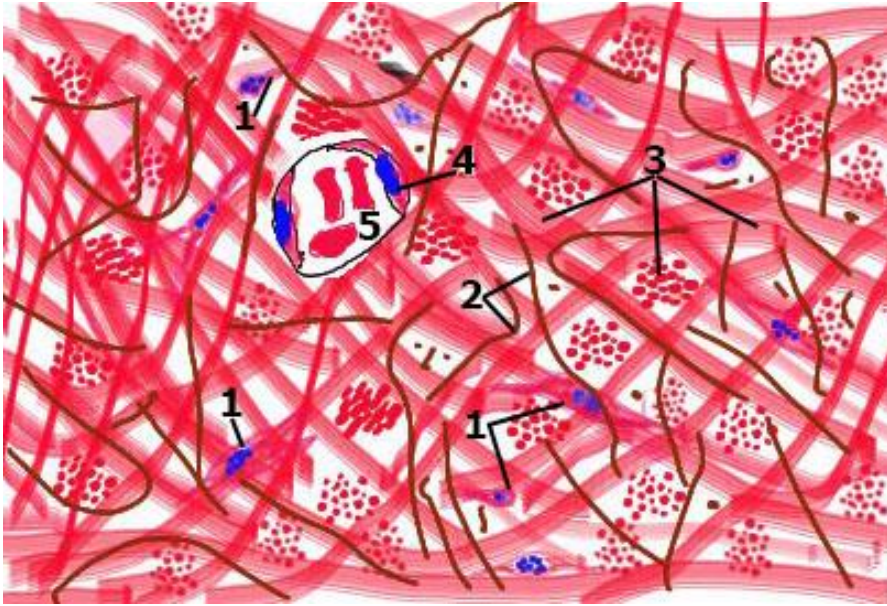
Şəkil 17.1.

Рисунок 17.1.

Figure 17.1.

Schematic illustration of tendon

1. Bundles of collagen fibers 2. Nucleus of fibrocyte 3. Connective tissue elements



Şəkil 17.2.

Рисунок 17.2.

Figure 17.2.

Dense irregular connective tissue

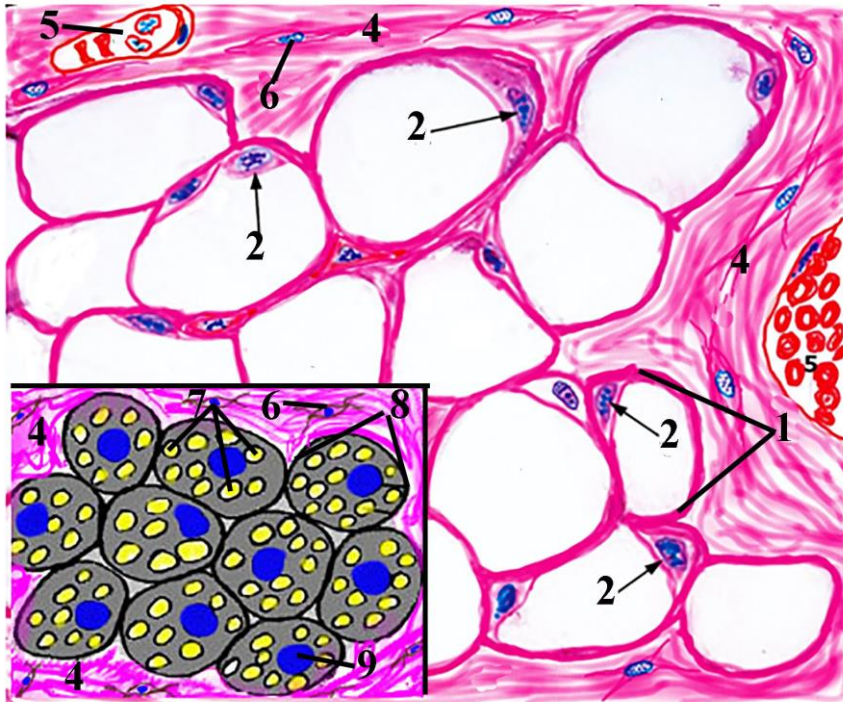
1 fibroblast

2 elastic fibers

3 collagen fibers

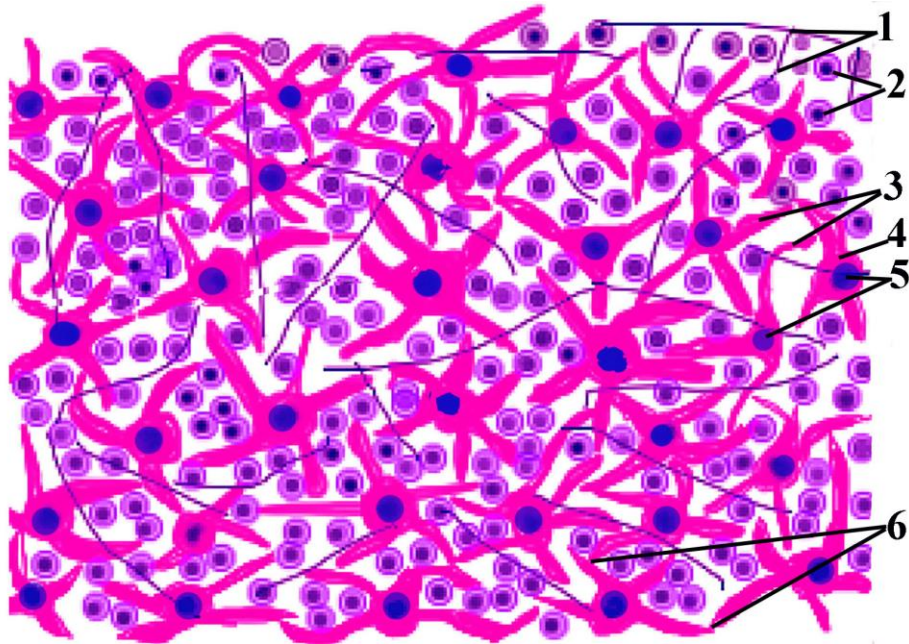
4 endothelial cells

5 blood vessels



Şəkil 17.3. Рисунок 17.3. Figure 17.3.
Histological structure of white and brown adipose tissue

- 1. Unilocular adipose cell; 2. Nucleus of unilocular adipose cell;
- 4. Connective tissue elements; 5. Blood vessels; 6. Fibrocyte.
- 7. lipid droplet in cytoplasm of multilocular adipose cell
- 8 multilocular adipose cell (brown adipose tissue) 9. nucleus of multilocular adipose cell



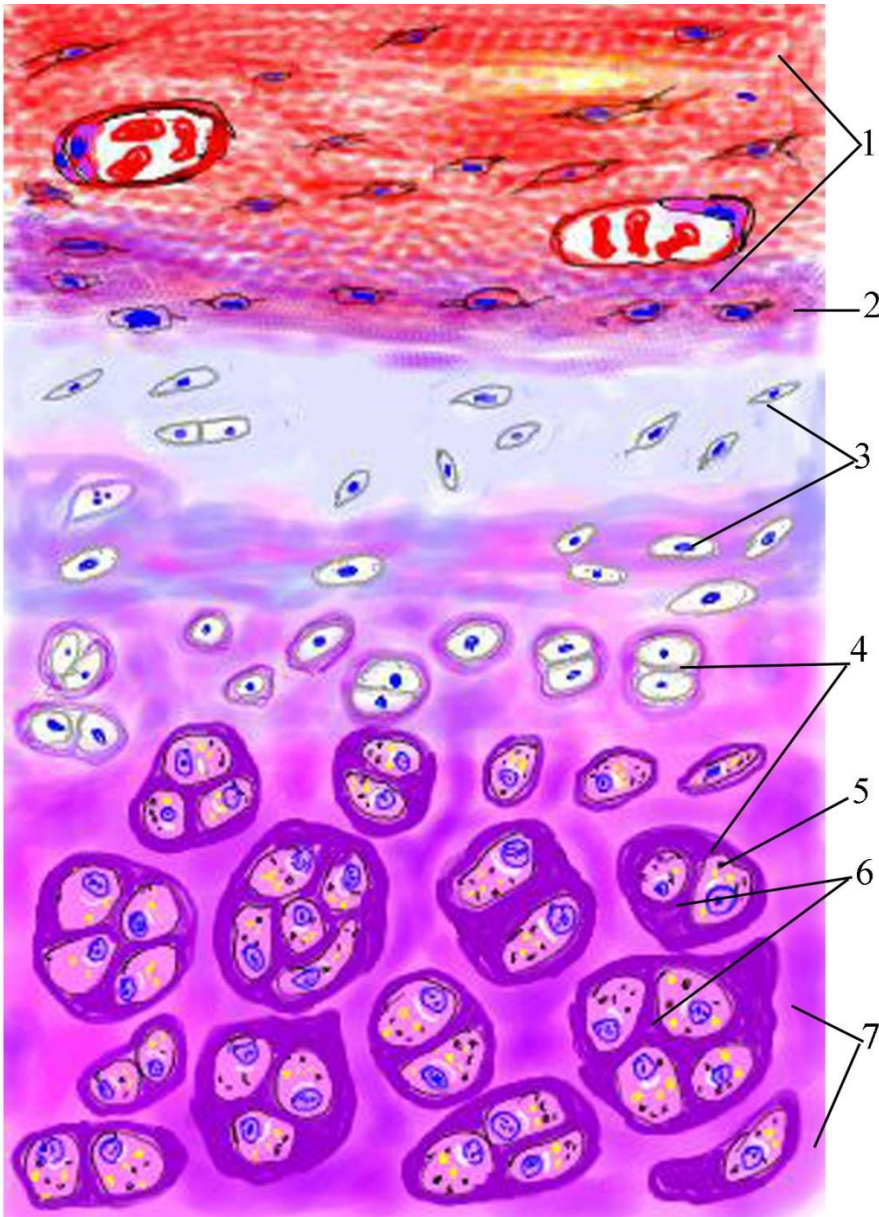
Şəkil 17.4.

Рисунок 17.4.

Figure 17.4.

Microscopic structure of reticular tissue.

- 1. reticular fibers
- 2. Lymphocytes
- 3. Processes of reticular cells
- 4 cytoplasm of reticular cells
- 5. Nucleus of reticular cells
- 6.interreticular cell junction (contact)



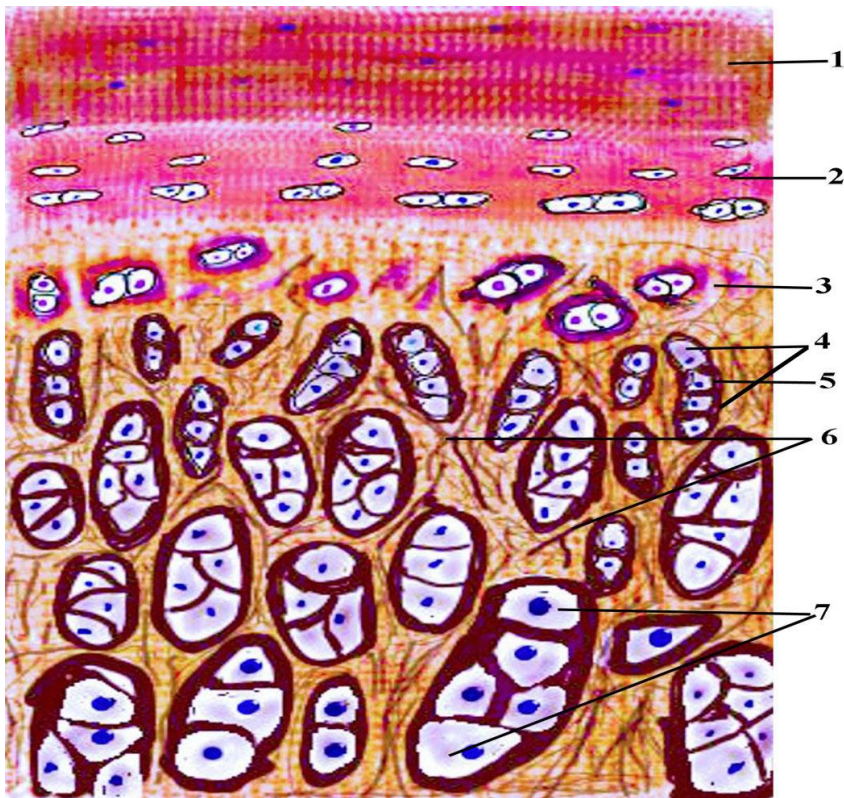
Şəkil 18.1.

Рисунок 18.1.

Figure 18.1.

Schematic illustration of hyaline cartilage.

1. perichondrium
2. chondrogenic (inner cellular) layer
3. newly formed chondrocytes
4. isogenous groups
5. mature chondrocytes
6. territorial matrix
7. interterritorial matrix



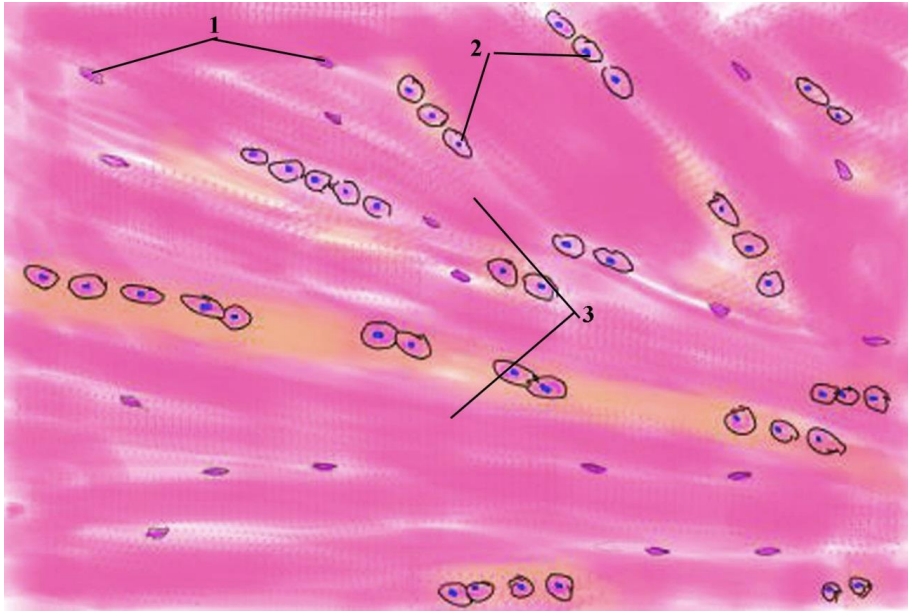
Şəkil 18.2.

Рисунок 18.2.

Figure 18.2.

Schematic illustration of elastic cartilage.

1. **Dense connective tissue elements**
2. chondrogenic (cellular) layer
3. isogenous groups formed matrix
4. isogenous groups
5. capsular matrix
6. elastic fibers
7. chondrocytes



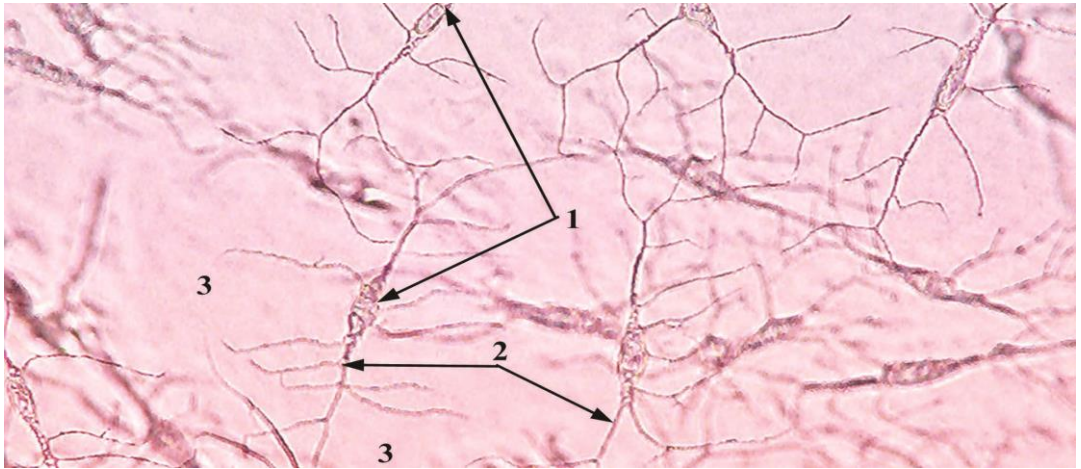
Şəkil 18.3.

Рисунок 18.3.

Figure 18.3.

Schematic illustration of fibrocartilage.

1. fibrocyte
2. central parts of chondrocytes
3. bundles of collagen fibers



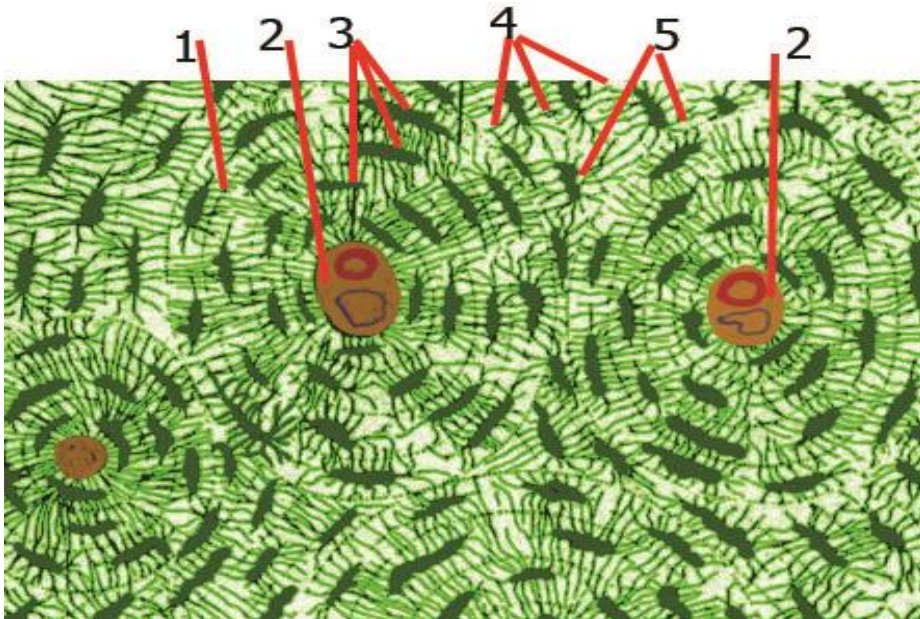
Şəkil 19.1.

Рисунок 19.1.

Figure 19.1.

Primary woven bone tissue. Unstained.

1. osteocytes
2. processes of osteocytes
3. extracellular matrix



Şəkil 19.2.

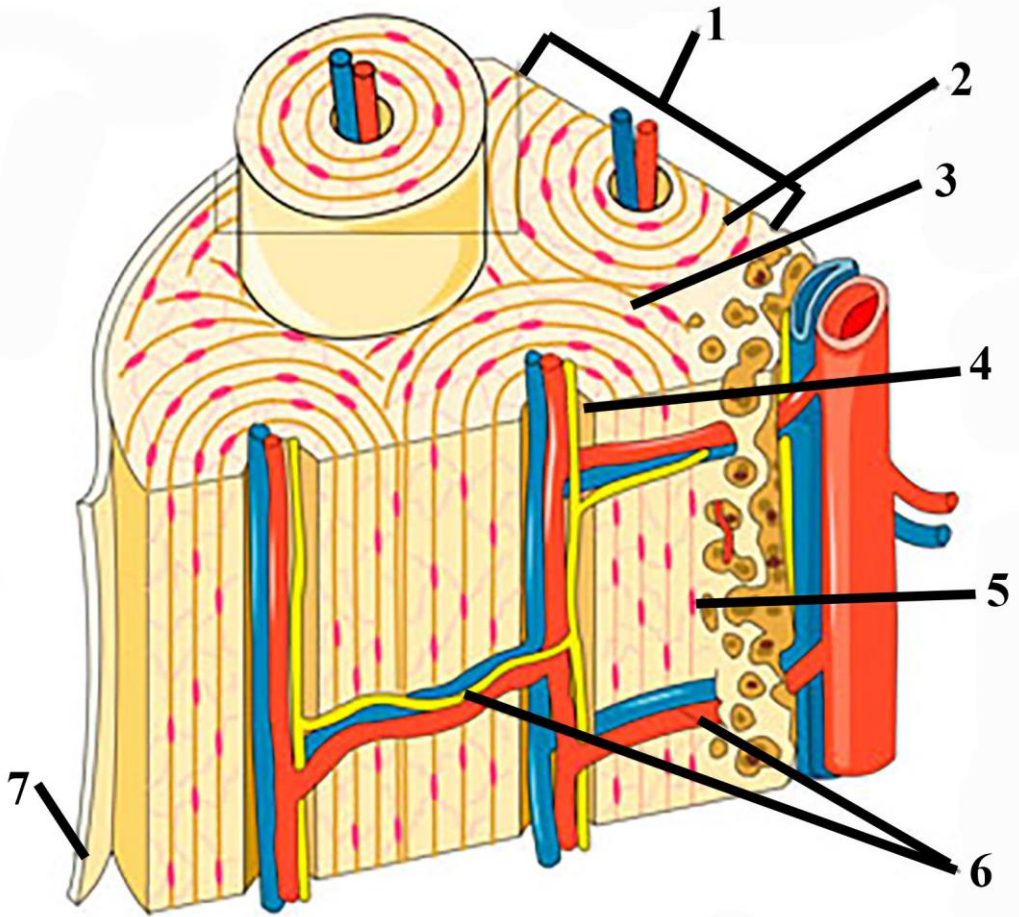
Рисунок 19.2.

Figure 19.2.

Secondary lamellar bone tissue. In transitional section.

Stain: picrofuchsine-thionine.

1. concentric lamellae
2. Haversian canal
3. osteocyte
4. interstitial lamellae
5. processes of osteocyte



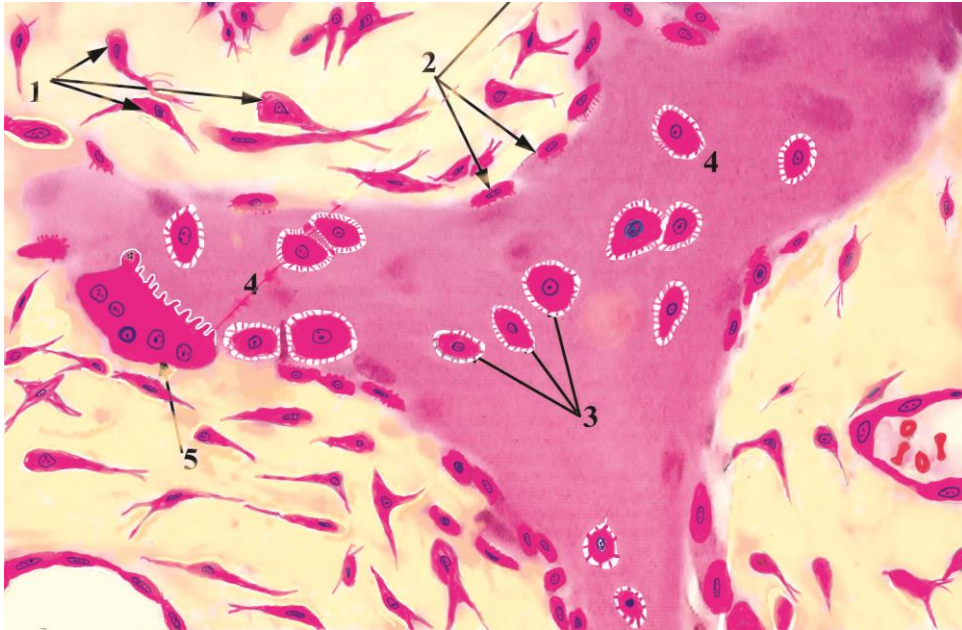
Şəkil 19.3.

Рисунок 19.3.

Figure 19.3.

Schematic illustration of the lamellar bone

1. Haversian system (osteon)
2. lacuna for osteocyte
3. concentric Haversian lamellae
4. Haversian canal
5. osteocyte
6. Volkmann's canal
7. periosteum



Şəkil 19.4.

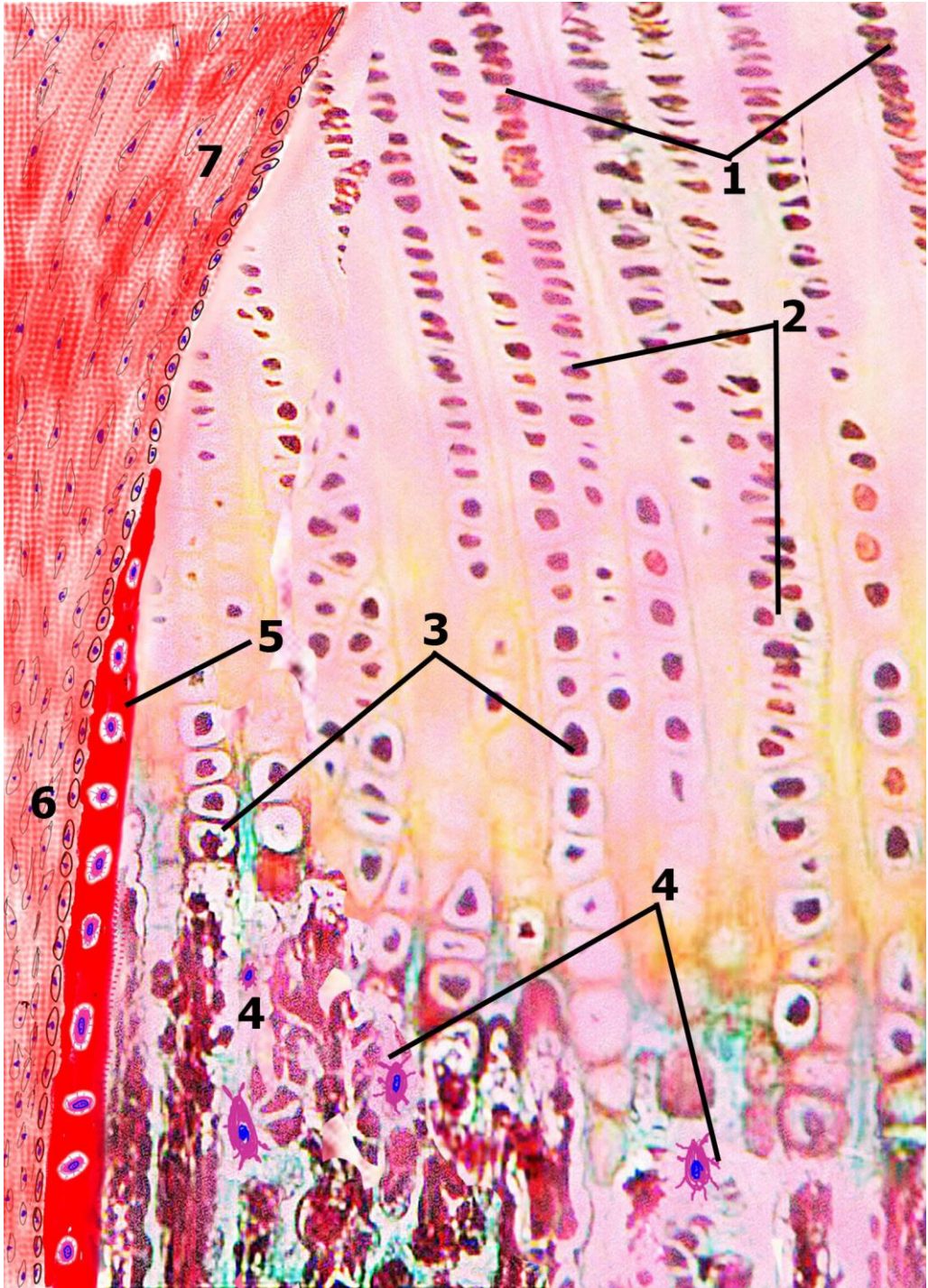
Рисунок 19.4.

Figure 19.4.

Intramembranous ossification of bone.

Stain: hematoxylin-eosin.

1. mesenchymal cells
2. osteoblasts
3. osteocytes
4. bone islet
5. osteoclast



Şəkil 19.5.

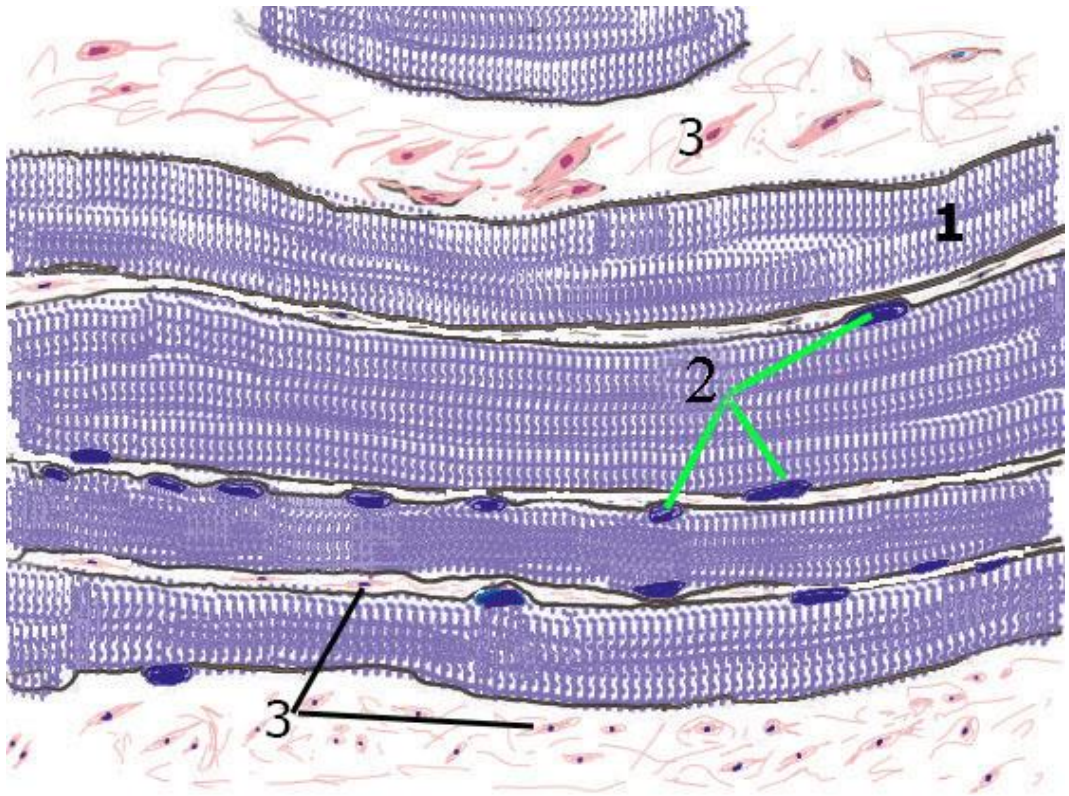
Рисунок 19.5.

Figure 19.5.

Endochondral ossification in pig embryo bone.

Stain: hematoxylin-eosin.

1. epiphyseal hyaline cartilage
2. proliferated chondrocytes
3. hypertrophied and destructed chondrocytes
4. endochondral bone lamellae
5. perichondral bone manjet
6. periosteum
7. perichondrium



Şəkil 20.1.

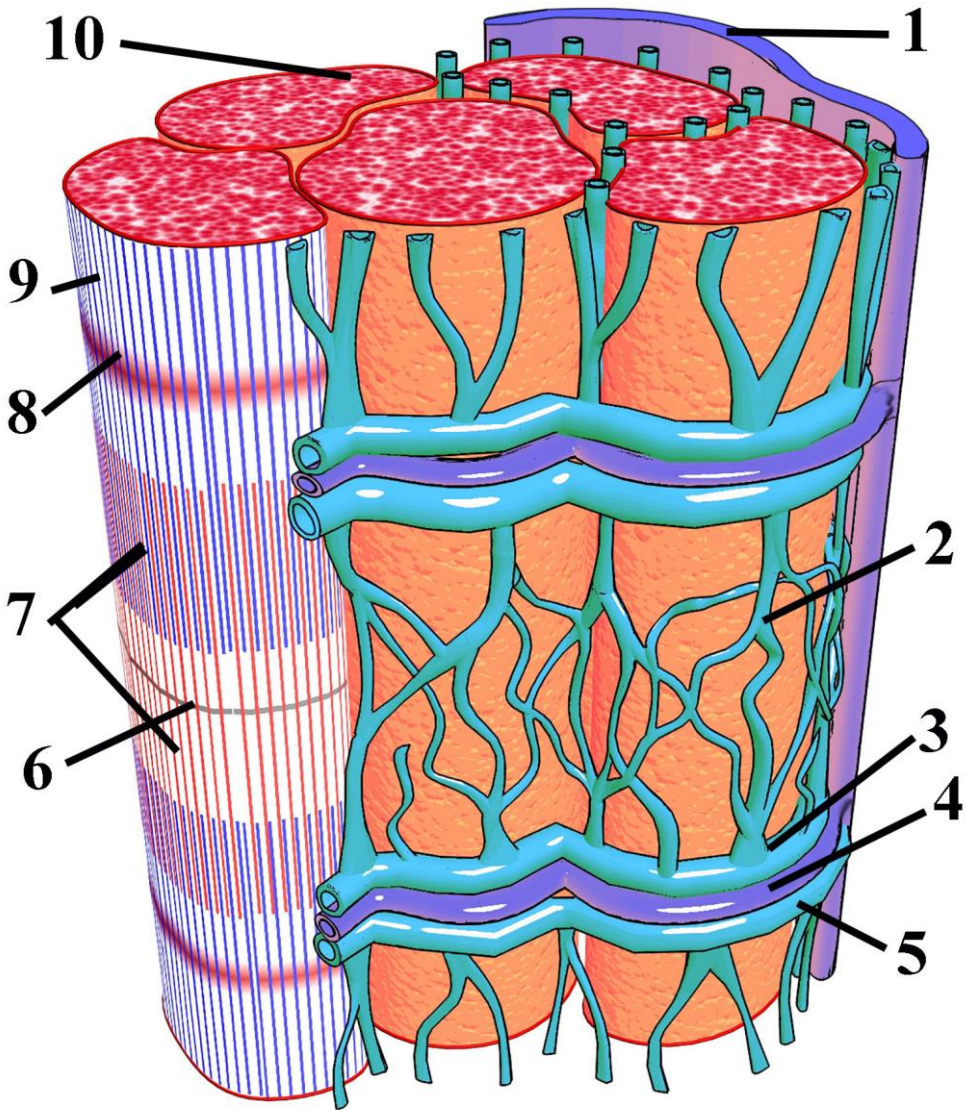
Рисунок 20.1.

Figure 20.1.

Structure of striated skeletal muscle fibers.

Stain: ferrous hematoxylin.

1. striated muscle fibers
2. nuclei
3. connective tissue elements.



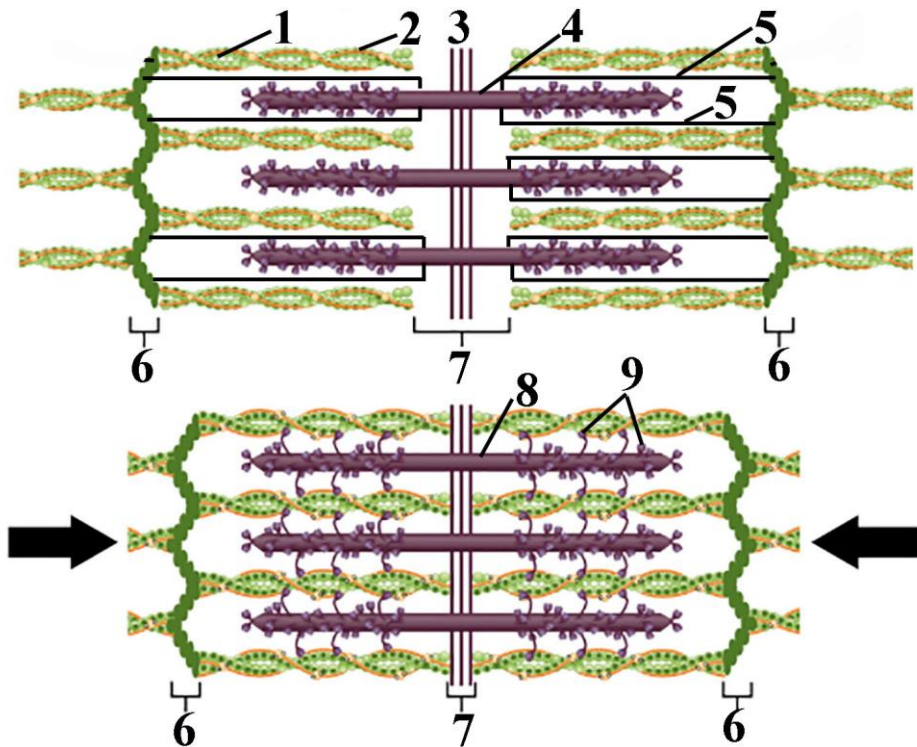
Şəkil 20.2.

Рисунок 20.2.

Figure 20.2.

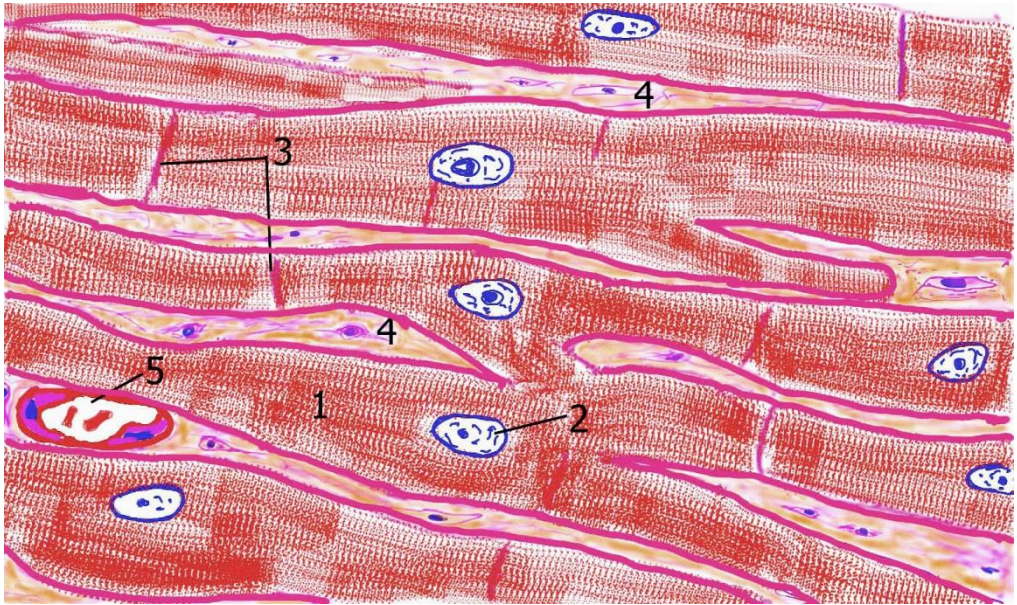
Schematic representation of striated muscle fiber.

1. sarcolemma
2. tubules of sarcoplasmic reticulum
3. upper terminal cistern
4. T-tubules.
5. Lower terminal cistern
6. M line
7. anisotropic band
8. Z line
9. isotropic band
10. muscle fiber in cross section



Şəkil 20.3. Рисунок 20.3. Figure 20.3.
Schematic representation of striated muscle fiber in relaxed (up) and contracted (down) position

1. actin 2. nebulin 3. M line 4 and 8 thick filament (myosin) 5 titin 6 Z line 7 H band 9 head of myosin



Şəkil 20.4.

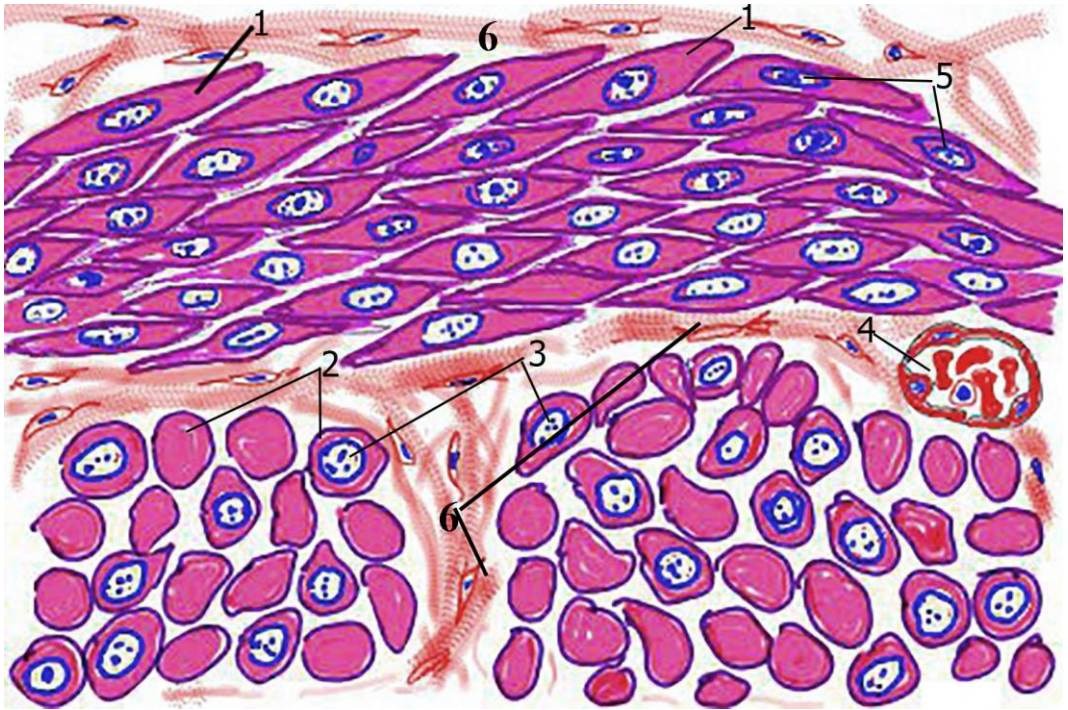
Рисунок 20.4.

Figure 20.4.

Myocardium. Longitudinal section.

Stain: hematoxylin-eosin.

- 1. functional muscle fiber- cardiomyocytes
- 2. nucleus of cardiac muscle cell
- 3. intercalated disks
- 4. connective tissue elements
- 5. hemocapillary.



Şəkil 20.5.

Рисунок 20.5.

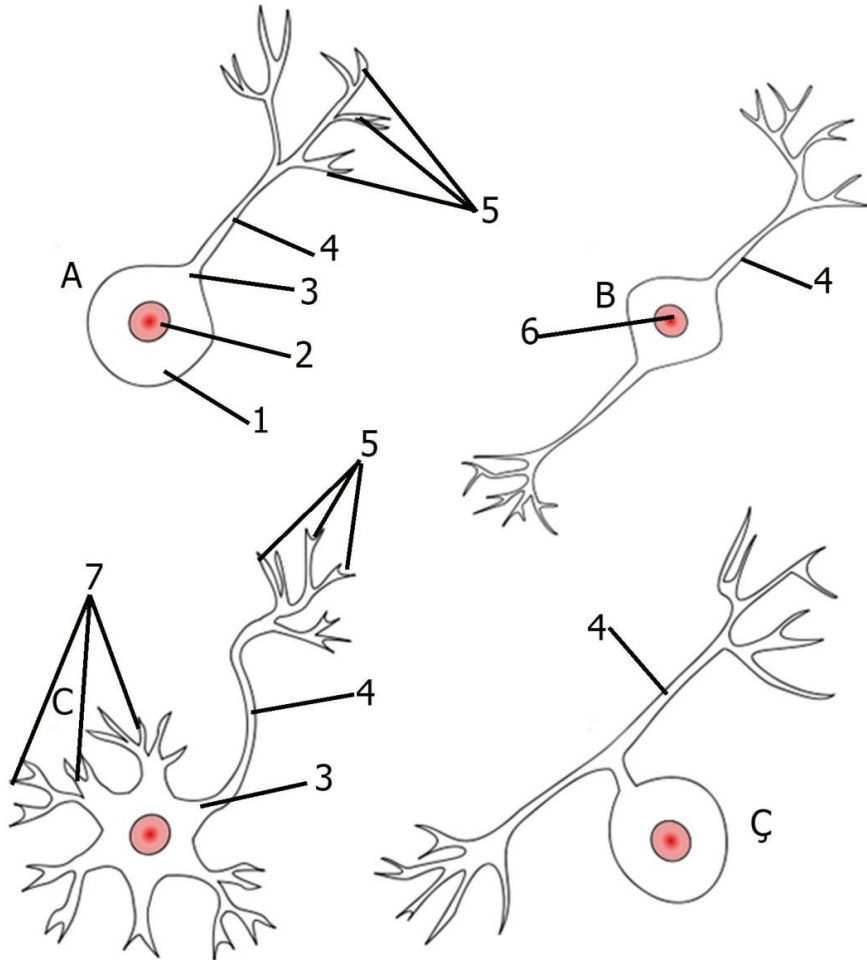
Figure 20.5.

Smooth muscle tissue

- 1. smooth muscle cells in longitudinal section
- 2. smooth muscle cells in cross section
- 3. nucleus of smooth muscle cells in cross section
- 4. blood vessels
- 5. nucleus of smooth muscle cells in longitudinal section
- 6. connective tissue elements

Sinir toxuması. Neyrositlər. Qliositlər.

21



Şəkil 21.1.

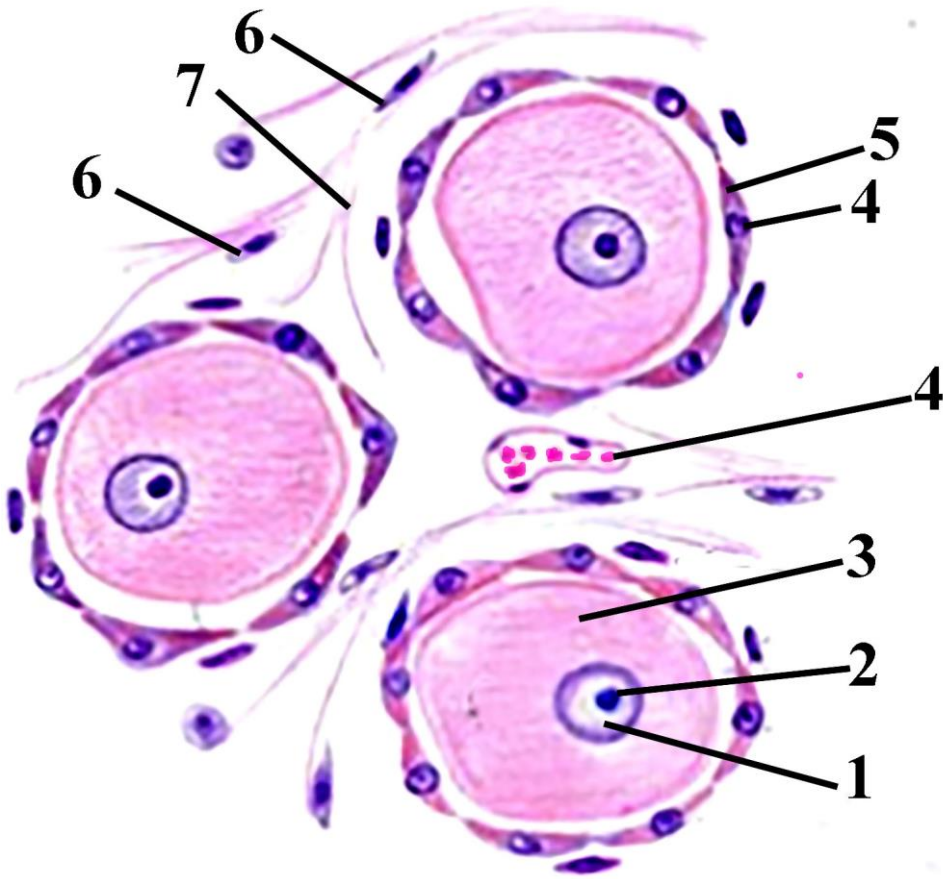
Рисунок 21.1.

Figure 21.1.

Basic neurone types.

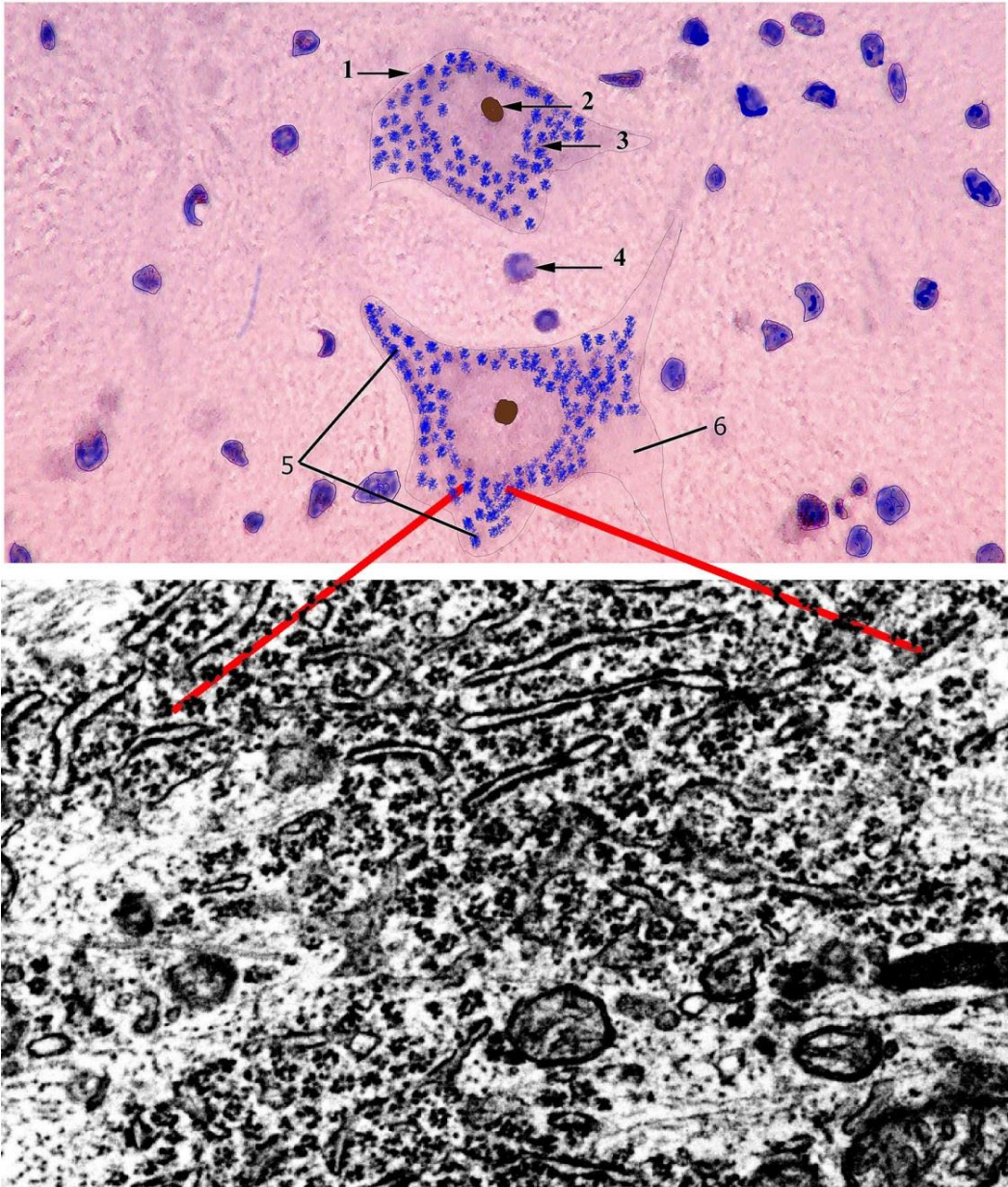
- A unipolar neuron B Bipolar neuron C Multipolar neuron C1
Pseudounipolar neuron
1. cell body of neuron

2. nucleus of neuron
3. axonal hillock
4. axon
5. telodendrites.
6. nucleolus
7. dendrites



Şəkil 21.2. Рисунок 21.2. Figure 21.2.
Schematic illustration of pseudounipolar neuron and surrounding structures in spinal ganglia

1. nucleus of neuron 2. nucleolus of neuron 3. cytoplasm of neuron
 4. satellite glial cells (up) 4. blood vessels (down) 5 cytoplasm of satellite glial cell
 6 fibrocyte 7 collagen fibers



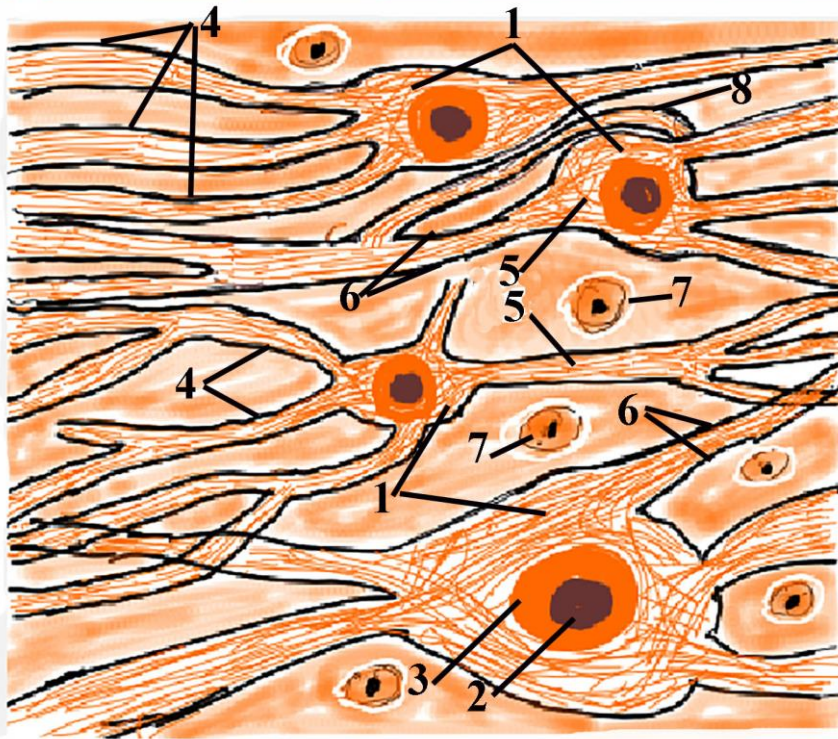
Şəkil 21.3.

Рисунок 21.3.

Figure 21.3.

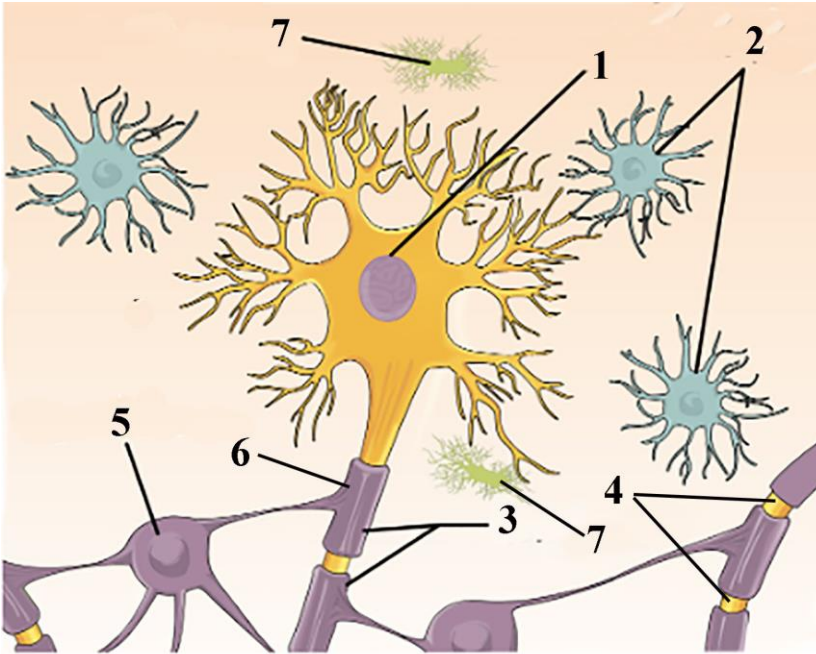
Chromatophilic substance (Nissle body) inside of multipolar neurons located in anterior horn of spinal cord. Stain: toluidine blue. Lower illustration is electron micrograph.

1. Neuron; 2. Nucleus of neuron; 3. Chromophilic substance; 4. Nucleus of neuroglial cell; 5. Dendrites; 6. Axonal hillock.



Şəkil 21.4. Рисунок 21.4. Figure 21.4.
Schematic illustration neurofibrils in cell body and process of neurons

1 multipolar neuronal cell body 2 nucleolus of neuron 3 nucleus of neuron 4 dendrites 5 neurofibrils 6 axons 7 neuroglial cells 8 axonal collaterals

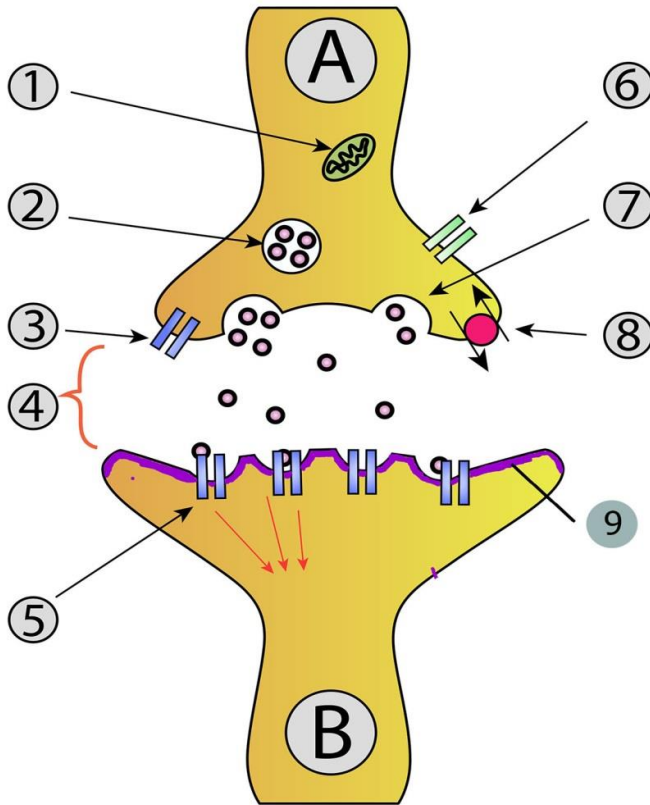


Şəkil 21.5.

Рисунок 21.5.

Figure 21.5.

Schematic representation of the constituent elements of the nervous tissue.
1. the nucleus of a neuron, 2. astrocytes, 3. myelinated nerve fiber, 4. Node of Ranvier, 5. Oligodendrocyte, 6. myelin sheath, 7. microglia



Şəkil 22.1.

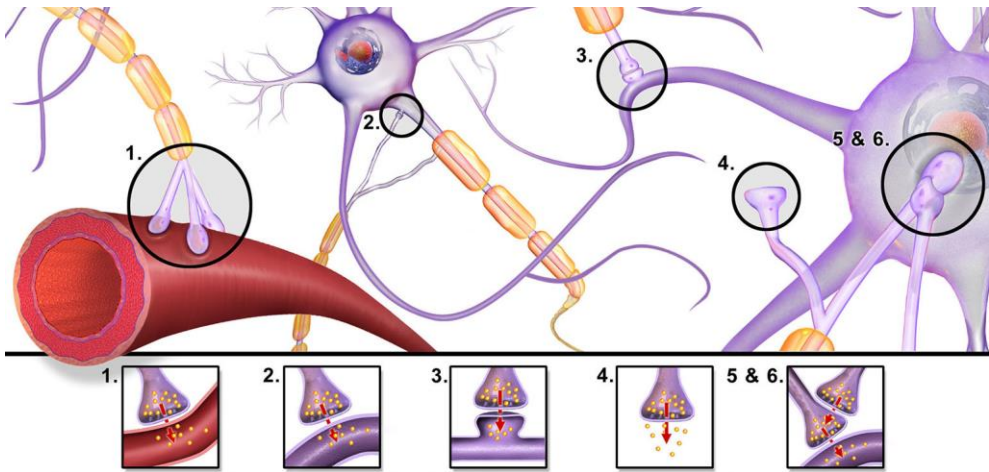
Рисунок 22.1.

Figure 22.1.

Schematic representation of synapse

A) presynaptic membrane; B) postsynaptic membrane

- 1 Mitochondrion 2 secretor vesicle 3 autoreceptor 4 synaptic cleft 5postsynaptic receptor 6 Ca²⁺ channel 7 exocytose 8 recirculation of neuromediators 9 postsynaptic density**



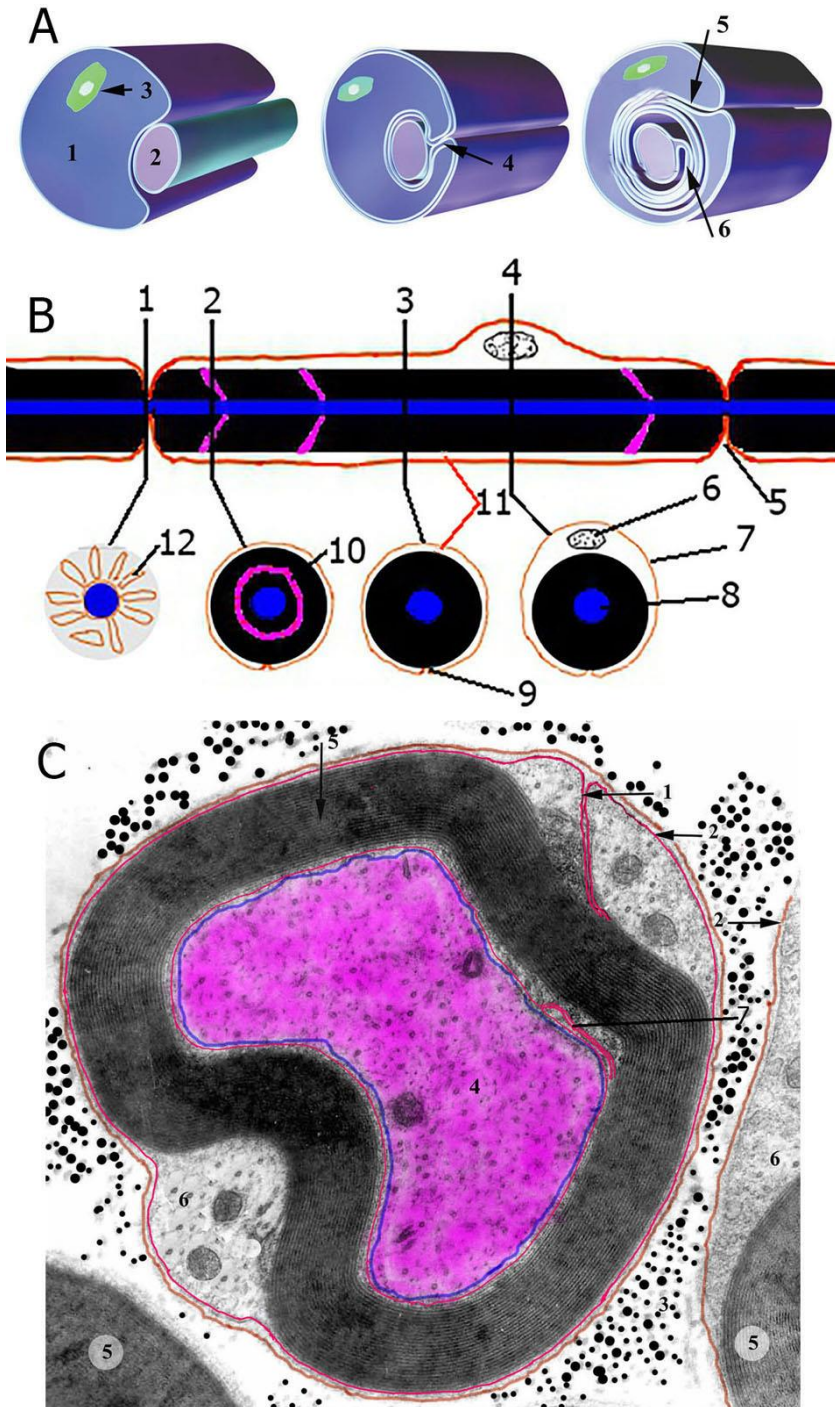
Şəkil 22.2.

Рисунок 22.2.

Figure 22.2.

Types of synapses

1. axosecretor (neurosecretor) synapse; 2. axoaxonal; 3. axodendritic; 4. axoextracellular; 5 and 6. axopresynaptic and axosomatic



Şəkil 22.3.

Рисунок 22.3.

Figure 22.3.

Myelinated nerve fiber

A. Schematic illustration myelinated nerve fiber formation.

1. neurolemmocyte (Shwann cell); 2. axon; 3. mesaxon; 4. outer mesaxon; 5. inner mesaxon.

B. Schematic illustration myelinated nerve fiber parts.

1, 5 . Node of Ranviere 2. part of myelinated nerve fiber related to region of node of Ranveire; 3. internodal segment without nucleus; 4. internodal segment including nucleus; 6. nucleus of Shwann cell; 7. cell membrane; 8. myelin coat; 9. outer mesaxon; 10. regions of Shmit Lanterman; 11. cytoplasm of Shwann cell; 12. processes of Shwan cell.

C. Electron microscopical illustration of myelinated nerve fiber cross section.

1. outer mesaxon; 2. basal lamina of neurolemmocyte; 3. bundles of collagen fibers; 4. process of nerve cell; 5. myeline coat; 6. cytoplasm of neurolemmocyte. 7. inner mesaxon;



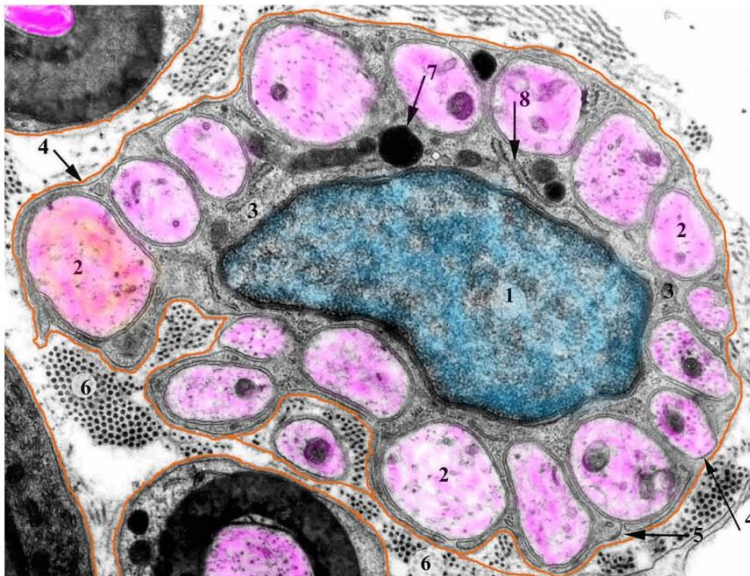
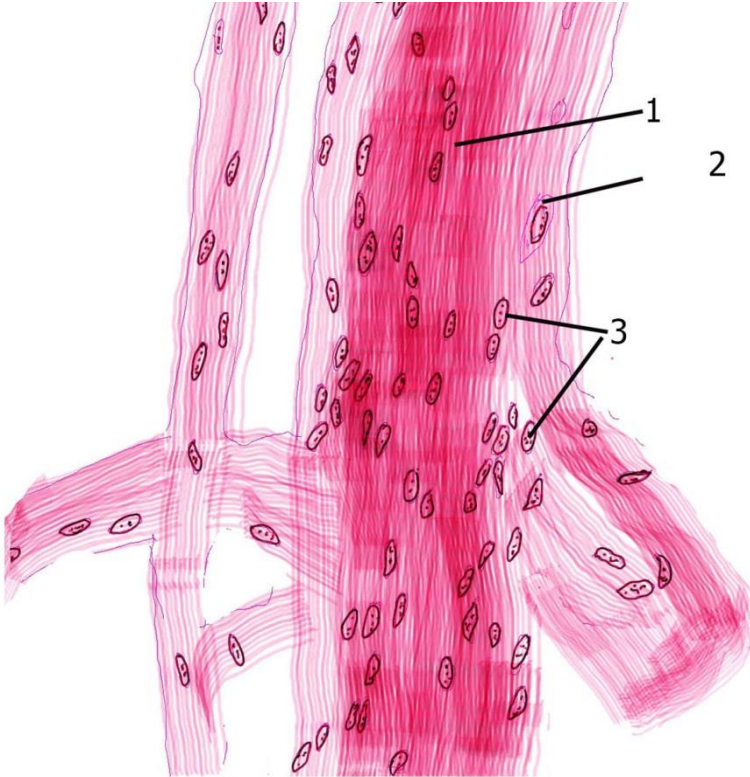
Şəkil 22.4.

Рисунок 22.4.

Figure 22.4.

Schematic illustration myelinated nerve fiber

1 node of Ranvier 2 segment of myelin 3 Schwann cell



Şəkil 22.5.

Рисунок 22.5.

Figure 22.5.

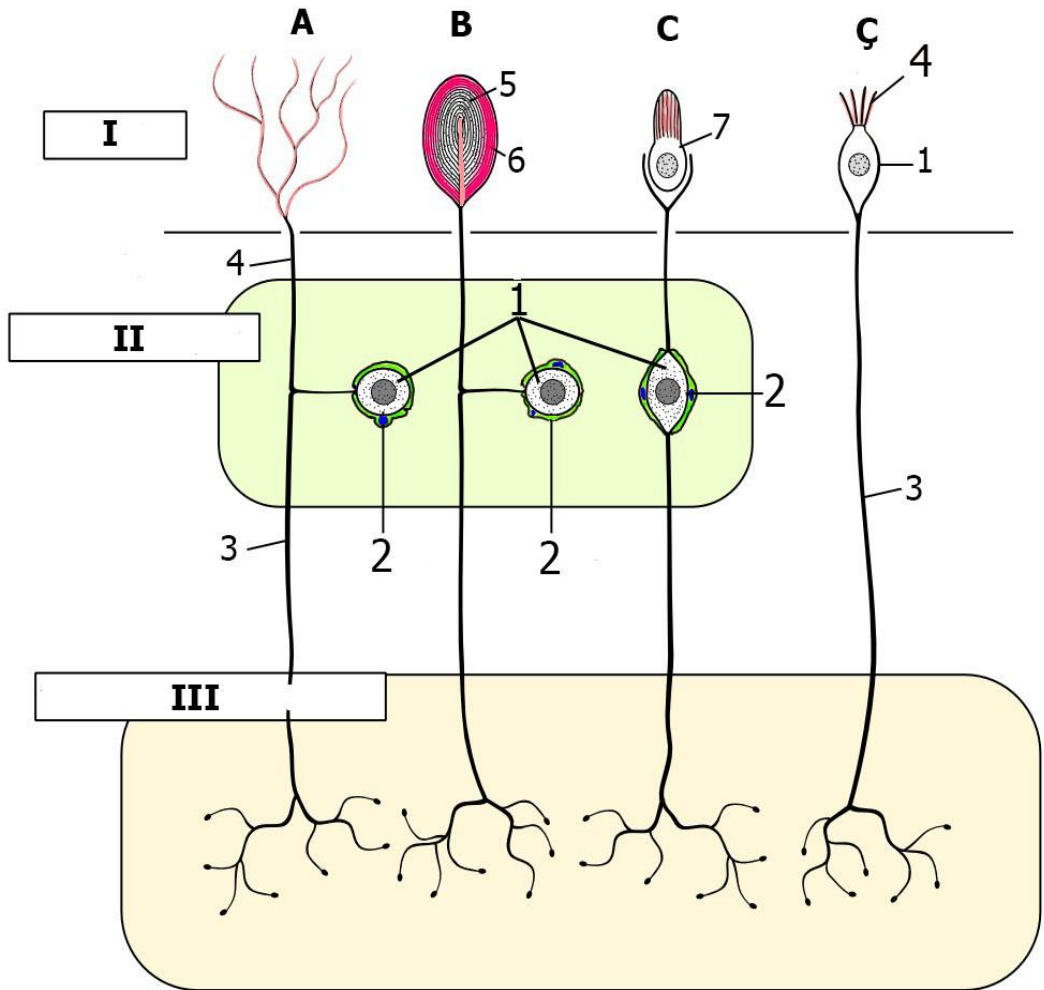
Nonmyelinated nerve fiber.

Upper illustration. Longitudinal section of unmyelinated nerve fiber.

1. bundle of unmyelinated nerve fibers;
2. body of neurolemmocyte;
3. nucleus of neurolemmocyte.

Lower illustration. Cross section of unmyelinated nerve fiber.

1. nucleus of neurolemmocyte;
2. process of nerve cell;
3. cytoplasm of neurolemmocyte;
4. basal lamina of neurolemmocyte;
5. mesaxon;
6. bundle of collagen fibers;
7. lisosom;
8. RER.



Şəkil 22.6.

Рисунок 22.6.

Figure 22.6.

Schematic illustrations of reseptor types and their interrelations.

I. Receptors; II. Region of location of sensory neuron cell body; III. Area of synaptic contacts between terminal branches of sensory neuron and interneuron.

A. Free nerve ending; B. Capsulated nerve ending; C. Epitiosensor nerve ending; Ç. Neurosensor nerve ending.

1. cell bodies of neurons; 2. glial cells; 3. axons; 4. dendrites; 5. inner layer of capsule; 6. outer layer of capsule; 7. sensory epithelial cell.

Referat için

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**Dərs vəsaitinin tərtibi zamanı istifadə olunmuş şəkillər,
elektronqramlar, sxemlər və cədvəllərin götürüldüyü
ədəbiyyatların**

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