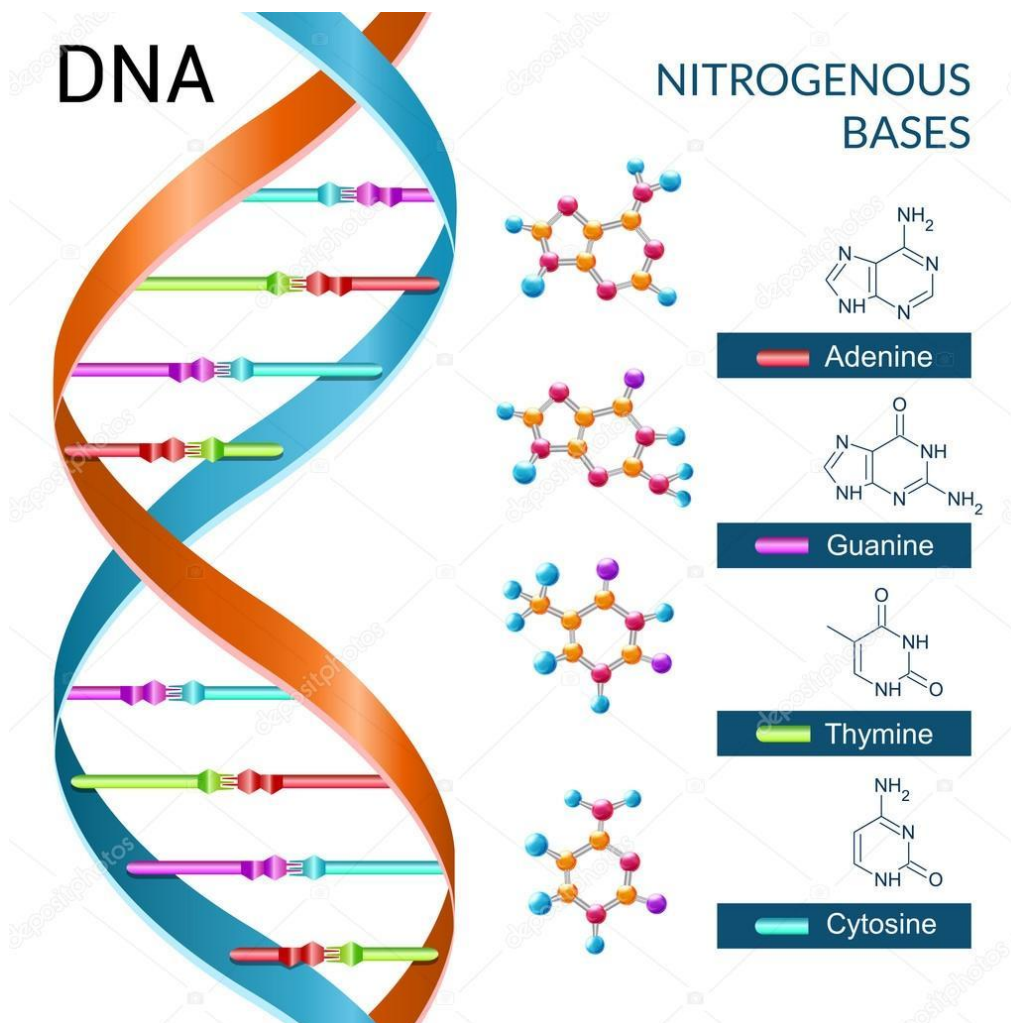


MINISTRY OF PUBLIC HEALTH OF UKRAINE
Ukrainian Medical Stomatological Academy

*Preparatory department for
foreign students*

Basics of general histology and cytology
Study guide for foreign students



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Preface

Methodical development is based on the biology program for foreign students studying at the preparatory departments of universities of medical and biological profile.

The materials studied are divided into eighteen classes. Materials for each lesson include: a dictionary of new terms needed to study the topic; lexico-grammatical structures, the activation of which eliminates the difficulty involved in perception of educational material; teaching text adapted in accordance with the language background of students at this stage of study; materials for reviewing and self-control of knowledge.

New lexical units are presented in a lesson-based dictionary, not in alphabetical order, but as they are used in the class text.

Methodical development contains drawings, diagrams, tables that help students with the learning of a new topic in the preparation of their own statements on the material studied.

This methodical development does not include materials for laboratory and examinations, as they are offered to students in a separate collection.

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Class 1. Chemical composition of the cell.**Task 1. Listen, repeat and read words and phrases:**

detect / reveal	виявляти, виявити	обнаружи- вать/обнаружить	détecter / localiser	يكتشف، فشتكا
macroelement	макроелемент	макроэлемент, -ы	nutriments, s	ريبيك رصنع
microelemen	мікроелемент	микроэлемент, -ы	oligo-élément,	قيقد رصنع
lipid, s	ліпід	липид, -ы	lipides,	تاينهذ
lipoid, s	ліпоїд	липоид, -ы	lipoïde	تاينهذ (تايمحشو)
hemoglobin	гемоглобін	гемоглобин	hémoglobine	نبيولوجوميه
chlorophyll	хлорофіл	хлорофилл	chlorophylle	ليفورولك
vital activity	життєдіяльність	жизнедеятельность	activité de la vie	حيوية (نشاط حيوي)
thyroid	щитовидна залоза	щитовидная железа	thyroïde	تيقردلا تدغلا
pancreas	підшлункова залоза	поджелудочная железа	pancréas	كنبلا تدغلا تيساير
hormone, -s	гормон	гормон, -ы	hormono-s	نومره
vitamin	вітамін, -и	витами́н, -ы	vitamine	نيماتيف
pigment	пігмент, -и	пигмент, -ы	pigment	تغيصد
thyroxine	тіроксин	тироксин	thyroxine	نيسكورين
insulin	інсулін	инсулин	insuline	نيلوسنلا
transfer	переноси- ти/перенести	переносить/перенести	transfer	لقندي

Pay attention!**make up [verb]**

to form by fitting together or assembling

Matter is made up of elements.

consist of [phrasal verb]

to be formed or made up of (specified things)

Matter consists of chemical elements in pure form and in combinations called compounds.

Task 2. Listen, read and write in the notebook text.**Text**

All the chemical elements that make up plant and animal cells are found in nature. Today, chemists recognize 20 elements of Mendeleev's periodic system occurring in nature.

In living organisms, elements such as oxygen (O), hydrogen (H), nitrogen (N), calcium (Ca), phosphorus (P), sulfur (S), potassium (K), chlorine (Cl), sodium (Na), magnesium (Mg), iodine (I), iron (Fe). These elements are called macroelements. They make up 99,59% of the cell mass.

Elements of copper (Cu), manganese (Mn), molybdenum (Mo), cobalt (Co), boron (B), zinc (Zn), fluorine (F), selenium (Se), chromium (Cr) are called trace elements. They are part of living organisms in very small quantities ($m \geq 0.01\%$). Trace elements are those required by an organism in only minute quantities.

Table 1.1. Chemical elements found in animals and their approximate content (in weight percent).

Element	Symbol	Content, %
Oxygen	O	62
Carbon	C	20
Hydrogen	H	10
Nitrogen	N	3
Calcium	Ca	2,5
Phosphorus	P	1,0
Sulfur	S	0,25
Potassium	K	0,25
Chlorine	Cl	0,2
Sodium	Na	0,10
Magnesium	Mg	0,07
Iodine	I	0,01
Iron	Fe	0,01
		99,59

Trace elements

Copper	Cu
Manganese	Mn
Molybdenum	Mo
Cobalt	Co
Boron	B
Zinc	Zn
Fluorine	F
Selenium	Se
Chromium	Cr

Chemical elements are part of inorganic compounds. Inorganic compounds include water, mineral salts, carbon dioxide, acids and bases. Organic compounds are proteins, nucleic acids, carbohydrates, lipids (fats) and lipoids. In addition to oxygen, hydrogen, carbon and nitrogen, some other elements can be included in their composition. Some proteins contain sulfur. The constituent part of the nucleic acids is phosphorus. The hemoglobin molecule contains iron, and magnesium is a part of chlorophyll.

Microelements play an important role in life processes. Iodine is an essential ingredient of a hormone thyroxine produced by the thyroid gland. Cobalt is an essential element of vitamin B12. The hormone insulin contains zinc. A copper-rich protein carries oxygen from the lungs to the bloodstream and then to the cells of some fishes bodies.

Task 3. Do the exercises.

Exercise 1. Complete the plan with the sentences.

Exercise 2. Answer the questions.

1. What macroelements do you know?
2. What is the role of macroelements in living nature?

3. What is microelements?
4. What microelements do you know?
5. What is the role of microelements?

Exercise 3. Complete the following sentences.

1. The constituent part of the nucleic acids is
2. The hemoglobin molecule contains
3. ... is an essential element of vitamin B12.
4. The hormone insulin contains
5. ... is an essential ingredient of a hormone thyroxine.

Class 2. Inorganic compounds of the cell and water.

Task 1. Listen, repeat and read words and phrases:

solvent	розчинник	растворитель, -и	solvant	بيزيم
solution	розчин	раствор, -ы	solution	لولحم
osmosis	осмос	осмос	osmose	زومسلا
osmotic pressure	осмотичний тиск	осмотическое давление	tension osmotique	ضلاي زومسلا طغ
penetration	проникнення	проникновение	envahissement	لغلغلتا
semipermeable	напівпрониклий	полупроницаемый, -ая, -ое, -ые	hémiperméable	ذفغم بعش
salt	сіль	соль, -и	sel	حلم
plasma	плазма	плазма	plasma	امزلا بلا
irritability	подразливість	раздражимость	irritabilité	جيهتلا ي لء تيلبا قلا
ratio	співвідношення	соотношение, -ия	quotient	طبارت بسانت تيسن
concentration	концентрація	концентрация, -ии	concentration	زيركتلا
buffer properties	буферні властивості	буферные свойства	tampon caractères,	خففختلا تقيصا
buffering	буферність	буферность	effet tampon	ففختلا ي لء تيلبا قلا
strength/stability	міцність	прочность	solidité	تقوتلا
ion	іон	ион, -ы	ion	نويا
cation	катіон	катион, -ы	cation	بجوم نويا
anion	аніон	анион, -ы	anio	بالاس نويا
bone tissue	кісткова тканина	костная ткань	tissu osseux	ي مظعلاجيسنلا
evaporation	випаровування	испарение, -ия	vaporisation	رخبتلا
hydrogen index pH	водневий показник	водородный показатель (PH)	indice pH	يني جورديهلا مقرلا

Pay attention!

form [verb]

to organize or arrange

Compounds formed by ionic bonds are called ionic compounds, or salts.

perform [verb] (do)

To do an action or piece of work

In extracellular fluids and in blood, the role of the buffer is performed by H_2CO_3 and HCO_3^- .

Task 2. Listen and repeat text.

Text

Water is one of the most common substance on Earth. It covers most of the Earth's surface and is the main component of cells of living organisms.

The water averages about 80% of the body weight. Water molecules have a special structure and can be linked to each other by hydrogen bonds. Therefore, water has a number of properties that are very important for living organisms.

Water is a good solvent. The most of the biochemical reactions in the cell can take place only in aqueous solution.

A liquid that is a completely homogeneous mixture of two or more substances is called a **solution**. The dissolving agent of a solution is the **solvent**, and the substance that is dissolved is the **solute**. An aqueous solution is one in which water is the solvent.

Water as a solvent takes part in the phenomena of osmosis. **Osmosis** is the spontaneous movement of solvent molecules through a semipermeable membrane into region of higher solute concentration, in the direction that tends to equalize the solute concentrations on the two sides a solution of a substance towards a higher concentration.

Water cools the body by evaporation.

Most of the inorganic substances of the cell are in the form of salts. The cell contains many potassium ions (K^+) and very few sodium ions (Na^+). In extracellular environment (for example, in blood plasma) on the contrary - many sodium ions and few potassium ions. The irritability of the cell depends on the ratio of the concentrations of ions Na^+ , K^+ , Ca^{2+} , Mg^{2+} on both sides of the membrane. The concentration of salts depends on the osmotic pressure in the cell and its buffer properties.

Buffering is the ability of a cell to maintain a slightly alkaline reaction of its contents at a constant level. Buffering inside the cell is provided by the $H_2PO_4^-$ and HPO_4^{2-} anions. In extracellular fluids and in blood, the role of the buffer is performed by H_2CO_3 and HCO_3^- . Anions of weak acids and weak acids bind hydrogen ions and hydroxide ions (OH^-). Therefore, the reaction within the cell and in extracellular fluids does not change in practice and depends on the pH of the environment. Insoluble mineral salts give a strength to bone tissue.

Task 3. Do the exercises.

Exercises 1. Make a text plan.

Exercises 2. Answer the questions.

1. What are the main properties of water and its importance to life?
2. What is osmosis?
3. In what form are the inorganic substances in the cell?
4. What cations and anions are contained in the cell?
5. What cations and anions are contained in the extracellular environment?
6. On what ions depends cell irritability?
7. What is buffering?
8. Which ions act as buffers in the cell and in the extracellular environment?

Exercises 3. Complete the sentences.

1. ... is one of the most common substance on Earth.
2. Water molecules have a special structure and can be linked to each other by

3. Osmosis is
4. Buffering is
5. Insoluble mineral salts give a strength
6. A liquid that a completely homogeneous mixture of two or more substances is called a

Class 3. Organic compounds of the cell.

Task 1. Listen, repeat and read words and phrases:

amino acid	амінокислота	аминокислота, -ы	aminoacide	يُنِيمِلَا ض مَحَلَا
peptide bond	пептидний зв'язок	пептидная связь	liaison peptidique	يُنِيمِيْبِلَا مَطْبَارِلَا
constructional /structural	будівельний	строительный, -ая, -ое, -ые	du bâtiment	يُنَانِبِلَا
enzyme	фермент, -ти	фермент, -ы (энзим, -ы)	ferment	مِيْزْنَا
fermentative	ферментативний	ферментативный, -ая, -ое, -ые	enzymatique	يُنِيمِيْزْنَا
locomotive /motive	руховий	двигательный, -ая, -ое, -ые	cinétique	يُنِيْكَرْحِيْ لِقَاذ
transport	траспортний	транспортный, -ая, -ое, -ые	de transport	يُنِيْ لِقَاذ
contractile	скоротливий	сократительный, -ая, -ое, -ые	contractile	يُنِيْضَابِقْنَا
protective	захисний	защитный, -ая, -ое, -ые	défensif	يُنِيْ عَاقِدْ، قَاو، مَاحِدْ
antibody	антитіло	антитело, -а	anticorps	دَاضِم مَسْجِدْ
antigen	антиген	антиген, -ы	antigène	بِيْر غ مَسْجِدْ
breakdown	розщеплення	расщепление, -ия	bifidité	ل مَاحِدِلَا
lipids	ліпід	липид, -ы	lipide	تَادِيْبِيْلَا، تَابِيْهْدِلَا
lipoid	ліпоїд	липоид, -ы	lipoïde	تَابِيْمَحْشِدْ، تَابِيْهْدْ
steroid	стероїд	стероид, -ы	stéroïdes	تَادِيْوْرْتِيْسِلَا
cholesterol	холестерин	холестерин	cholestérol	لُوْر تَسْلُوْكَ
excess	надлишок	избыток	excès	دِنَازْ، ضَنَافْ
specific	специфічний	специфический, -ая, -ое, -ие	spécifique	يُنِيْ عُوْدْ
cortisone	кортизон	кортизон	cortisone	نُوْرزِيْتْرُوْكَ
gallstone	жовчні каміння	желчные камни	cholélithe	مَطْبُوْر اِفْصَدْ عُوْصِدْ
hormone	гормон	гормон, -ы	hormone	نُوْمْرَهْ
deactivate	зnezаражувати зnezаразити	обезвреживать/обезвредить	neutraliser	ثُوْلْتَا ل اَزَا
neutralize	нейтралізувати	нейтрализовать	neutraliser	ل دَاعِيْ
glycerol	гліцерин	глицерин	glycérine	نِيْر سِيْلِجْ

Pay attention!

store [verb]

keep or accumulate (something) for future use

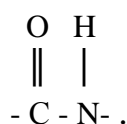
Plants store starch as granules within cellular structures called plastids.

Task 2. Listen and repeat text.

Text

Organic compounds include proteins, carbohydrates, nucleic acids and fats.

Proteins are high molecular weight biopolymers. Their monomers are amino acids. Living organisms use about 20 amino acids. Two amino acids are combined into one molecule using a **peptide bond**.



Proteins are polypeptides that contain dozens and hundreds of amino acids.

By their composition, proteins are divided into two main classes - simple and complex. Simple proteins consist of only amino acids.

Complex proteins, except amino acids, have lipids, carbohydrates, metal ions, and phosphorus in their composition.

Proteins perform different functions in cells. One of the most important is the building function: proteins participate in the formation of all cell membranes and cell organelles. The fermentative property of proteins is of great importance. Enzymes accelerate the biochemical reactions taking place in the cell many times. The motor function is provided by special contractile proteins. These proteins are involved in all types of movement.

The transport function of proteins is to attach chemical elements or biologically active substances (hormones) and transfer them to the tissues and organs of the body. The protective function of proteins is expressed in the production of specific proteins, which are called **antibodies**. Antibodies bind and neutralize foreign substances. The organism recognizes a foreign substance by the reaction between the antigens of this substance and the antibodies of the given organism. An antigen is any substance (which usually contains a protein) that can induce an immune reaction. Proteins are a source of energy. With the complete cleavage of 1 g of proteins, 17.6 kJ energy is released (4.2 kcal)

Carbohydrates are organic substances with the general formula $(\text{CH}_2\text{O})_n$.

In the animal cell, there are 1-5% carbohydrates.

Carbohydrates are simple and complex. Simple carbohydrates are called **monosaccharides**. Complex carbohydrates are called **polysaccharides**. Monomers of polysaccharides of starch, glycogen and cellulose are glucose monosaccharide.

Carbohydrates are organic substances with the general formula $(\text{CH}_2\text{O})_n$.

In the animal cell, there are 1-5% carbohydrates.

Carbohydrates perform two main functions: construction and energy. Cellulose forms the walls of plant cells. Complex polysaccharide chitin performs construction function in fungi and arthropods. Carbohydrates play the role of the main source of energy in the cell. During the oxidation of 1 g of carbohydrates, 17.6 kJ of energy (4.2 kcal) is released. Starch in plants and glycogen in animals is stored in cells.

Lipids (fats) are compounds of high molecular weight fatty acids and trihydric glycerol alcohol. Fats are a source of energy in the body and give it twice as much as carbohydrates. Fats are part of cytoplasmic membranes, nuclear envelope, myelin sheaths. The fat layer protects the animals from loss of heat and water. Lipids are part of the intermediate layer of cytoplasmic membranes. In a large number of lipids are contained in the cells of the nervous tissue of animals.

Steroids are lipids that have a cyclic structure. Steroids include a number of hormones (cortisone, sex hormones). Steroid cholesterol is an important component of cell membranes in animals. But excess cholesterol in the body can lead to the formation of gallstones and diseases of the cardiovascular system.

Nucleic acids are complex organic compounds that have very large molecules, which include monosaccharides (ribose and deoxyribose), nitrogenous bases (adenine, guanine, thymine, cytosine, uracil) and phosphoric acid.

Two types of nucleic acids are known: deoxyribonucleic (DNA) and ribonucleic (RNA). They got their name from monosaccharides, which are included in their composition: DNA is deoxyribose, and in RNA - ribose. DNA is contained in the nu-

nucleus of the cell, and RNA is in the cytoplasm and in the nucleus. DNA and RNA retain (store) and transmit hereditary information for specific proteins and other cell substances. DNA is the carrier of hereditary information.

Task 3. Do the exercises.

Exercises 1. Answer the questions.

1. What organic substances are included in the cell?
2. What structure do proteins have?
3. What are the functions of the proteins in the cell?
4. What structure do lipids have?
5. What are the functions of carbohydrates in the cell?
6. What structure do carbohydrates have?
7. What are the functions of the lipids in the cell?
8. What types of nucleic acids do you know?
9. What are the functions of the nucleic acids in the cell?

Exercises 2. Fill the table below.

Brief characteristics of main groups of organic compounds

Group	Role in living organisms
a) ...	1. The main source of energy. 2. Support function in plants.
b) ...	1. Components of biological membranes. 2. The form of energy storage. 3. Hormones.
c) Protein	1. 2.
d) ...	1. 2.

Class 4. Structure of the cell.

Task 1. Listen, repeat and read words and phrases:

metabolism	обмін речовин	обмен веществ (метаболизм)	métabolisme	تبادل المواد (الأيض)
semipermeable	напівпроникливість	полупроницаемость	semi-perméabilité	تَمَيِّزَاتُ مَبْشَد
capacity	здатність	способность, -и	faculté	قُدْرَة
overleap	пропускати/пропустити	пропускать/пропустить	tréfiler	رور ملابج حمسد
limit/restrict	обмежити	ограничивать/ограничить	restreindre	ددحيد، طيحي
injury	пошкодження	повреждение, -ия	altération	فسلاتا
regulate	регулювати	регулировать	régler	قسنذ، مظنذ، طبضذ
admission	надходження	поступление, -ия	admission	قأحتلا
enter	вводити/ввести	вводит/ввести	injecter	لخدأ
connect/join	з'єднувати/з'єднати	соединять/соединить	accoler	مضيد
phagocytosis	фагоцитоз	фагоцитоз	phagocytose	فوحف
colloidal solution	колоїдний розчин	коллоидный раствор	solution colloïdale	يور غ لولحم
make/commit	здійснювати/здійснити	совершать/совершить	commettre	مأ، زجنا
intensity	інтенсивність	интенсивность	intensité	ز يكرتلا
separate	відділяти/відділити	отделять/отделить	séparer	لصفيد
strip	стрічка	полоска, -и	bandelette	ططخم
pore, porus	пора	пора, -ы	lacune	لصف، مسوم
nucleoplasm	нуклеоплазма	нуклеоплазма	nucléoplasme	أونلا امزلاذ

nucleolus	ядерце	ядрышко, -и	plasmosome	تيونلا
chromatin	хроматин	хроматин	chromatine	نينامورك
chromosome	хромосома	хромосома, -ы	chromosome	موسومورك
gene	ген	ген, -ы	gène	نيج
penetrate	проникати/проникнути	проникать/проникнуть	infiltrer	لغلغيد
pinocytosis	піноцитоз	пиноцитоз	pinocytose	تمعلب
semifluid	напіврідкий	полужидкий, -ая, -ое, -ие	fluide	عنام
cyclosis	циклоз	циклоз	cyclose	تيمزلايوتيسلا تكرر حلا

Pay attention!

compose [verb]

(of elements) constitute or make up (a whole, or a specified part of it)

A nucleotide is itself composed of three parts.

Task 2. Listen and repeat text.

Text

Membranes of plants and animals are fundamental to the organization of the cell. In general, biological membranes consist of a double layer of phospholipids and other lipids. Diverse proteins are embedded in this lipid bilayer or attached to its surfaces. Through it, there is a metabolism between the cell and the environment. An important property of the cytoplasmic membrane is semipermeability.

Semipermeability is the ability of a cell membrane to pass through itself only certain molecules and ions of matter.

Plant cells have a protective cellulose membrane that performs a mechanical function, and animal cells have only a plasmalemma.

The main functions of the outer membrane are to limit the internal environment of the cell, protect it from damage, regulate the flow of ions and molecules, remove metabolic products and synthesized substances, connect cells to each other and form tissues.

Through the outer membrane, large particles (exocytosis) and liquid drops (pinocytosis) enter the cell. In microorganisms, the absorption of large particles is called **phagocytosis**.

Under the plasma membrane, there is the main part of the cell - the cytoplasm. It is a colloidal solution of proteins, fats and nucleic acids. The cytoplasm is in the semi-liquid (gel) state and makes circular motions - **cyclosis**. The intensity of cyclosis depends on the temperature, the amount of water and other factors. The metabolism takes place in the cytoplasm. The main function of the cytoplasm is to integrate into one and ensure the interaction of the nucleus and all cell organelles.

The nucleus is one of the most important components of the cell. From the cytoplasm it is separated by a nuclear envelope, which consists of two three-layer membranes, between which is a narrow strip of semi-liquid substance.

Through the pores of the nuclear envelope, there is a metabolism between the nucleus and the cytoplasm.

Under the nuclear membrane is a nucleoplasm that contains one or more nucleoli, DNA, RNA and proteins.

The nucleolus has a rounded shape and sizes from 1 to 10 μm or more. It synthesizes RNA and contains ribosomal RNA.

The complex of **DNA + the protein** of the nucleus is called **chromatin**. During the division of cells from chromatin, chromosomes are formed. Each species of

plants and animals has a constant number of chromosomes. The size and shape of chromosomes are characteristic for each species of man and animals.

In chromosomes, there are units of hereditary information - genes. Each gene controls the development of its hereditary trait. Genes are located in chromosomes in a certain order. Each gene takes its place (locus).

Most cells have one nucleus, but multinucleated cells also occur. The shape and size of the nuclei are diverse.

Task 3. Do the exercises.

Exercises 1. Make a text plan.

Exercises 2. Answer the questions.

1. What is cell membrane?
2. What functions does the cytoplasmic membrane perform?
3. What are the functions of cytoplasm?
4. What structure does the nucleus have?
5. What functions does the nucleus perform?

Exercises 3. Explain the meaning of the words:

phagocytosis, pinocytosis, cyclosis, semipermeability, gene, chromatin, exocytosis.

Class 5. Cell organelles.

Task 1. Listen, repeat and read words and phrases:

endoplasmic reticulum (ER)	ендоплазматична сітка	эндоплазматическая сеть	réticulum endoplasmique	تیمز الابودنلاا تکبشلا
mitochondrion	мітохондрія	митохондрия	mitochondrie	ایر دنکو تيم
Golgi complex /apparatus	Гольджі комплекс	сетчатый аппарат (аппарат Гольджи)	appareil de Golgi,	اسجاي جلوج م
ribosome	рибосома	рибосома	ribosome	تاموسوبيارلا
lysosome	лізосома	лизосома	lysosome	تاموسوزيللا
centrosome	центросома	центросома	corpuscule central	ريمورتنسلا
invaginations	інвагінації	инвагинации	intussusception	
rugged/rough	шорсткий	шероховатый	squarreux	نشخ
smooth	гладкий	гладкий	glabre	م عان
canal/channel	канал	канал	canal	قناة
cavity	порожнина	полость	cavité	فوج
granular	гранулярний	гранулярный	granulaire	يبيد
accumulate	накопичувати	накапливать/накопить	accumuler	عمج، رخدا
kernel/grain	зерно	зерно	grain	قرزب، تبج
achromatin spindle	ахроматинове веретино	ахроматиновое веретено	fuseau achromatique	ل كشلما تيلزغم طويخ
pole	полюс	полюс	pôle	بطقة
separation	розходження	расхождение	désunion	رابطشذلا
fiber	нитка	нить	fibre	طبخ، لبد
myofibril	міофібрила	миофибрилла	myofibrille	تيلضد تقيلا
neurofibril	нейрофібрила	нейрофибрилла	neurofibrille	تيلضد تقيلا
conduction	проведення	проведение	conduction	زجنا، دم، قوشد
impulse	імпульс	импульс	impact	ضبنلا
provide	забезпечувати/забезпечити	обеспечивать/обеспечить	accommoder	رفو، ن، مأ، ن، مضد

Pay attention!

Separation [mass noun]

the action or state of moving or being moved apart

Microtubules are responsible for the separation of chromosomes during cell division.

Task 2. Listen and repeat text.

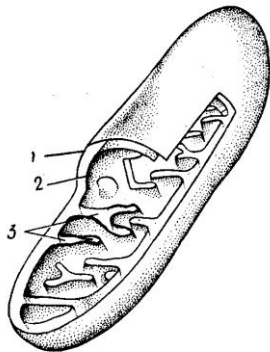
Text

The cell contains the following organelles: endoplasmic reticulum, mitochondria, Golgi apparatus, ribosomes, lysosomes, centrosome, special organelles.

Mitochondria (singular, mitochondrion) can vary greatly in both size (0.5 micrometers - 10 micrometers) and number (1 - over 1000) per cell. They have a double membrane: external and internal. The inner membrane forms **cristae** (invaginations). In the cavity of the mitochondria there are semi-liquid soluble proteins - **enzymes** (matrix), mitochondrial DNA, and ribosomes.

The main function of mitochondria is the synthesis of ATP - biological energy.

4



Mitochondrion

- 1-outer membrane;
- 2-inner membrane;
- 3-cristae.

Ribosomes have linear size of 0.015 micron. They consist of two subunits: large and small. Each subunit comprises one or more ribosomal RNA (rRNA) molecules and a variety of ribosomal proteins. Ribosomes are involved in the synthesis of protein molecules.

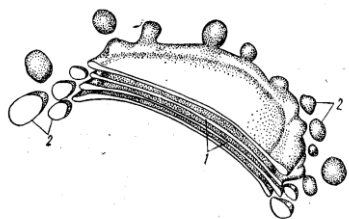
The **endoplasmic reticulum** (reticulum - network) is a special system of membranes. There are two types of endoplasmic reticulum:

- rough (granular);
- smooth (agranular).

On the membranes of the rough endoplasmic reticulum (RER) ribosomes are attached, which synthesize protein. Smooth endoplasmic reticulum (SER) is a network of fine tubular membrane vesicles, that is involved in the synthesis and storage of lipids, including cholesterol and phospholipids, which are used in the production of new cellular membrane. Thus, the endoplasmic reticulum is involved in the synthesis of proteins, lipids and in the transfer of synthesis products to different parts of the cell.

The **Golgi apparatus or complex** consists of cisterns, tubules and vesicles (bubbles). It looks like an endoplasmic reticulum. The Golgi apparatus or complex is the center of accumulation, packing and release of various substances (enzymes, hormones).

The products of cell synthesis and substances that come from the external environment, move through the channels of the endoplasmic reticulum into the net apparatus and accumulate there.



1-cisterns;
2-vesicles.

Golgi complex

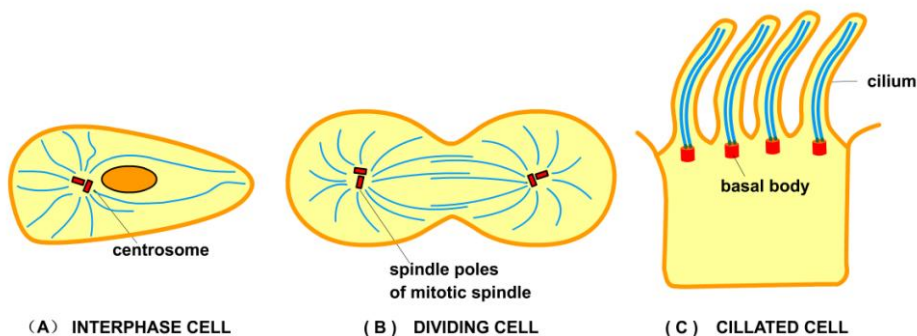
Lysosome is an organelle that contains digestive enzymes that break down proteins, polysaccharides, nucleic acids, fats, and other organic substances.

Plant cells also have plastids and vacuoles with cell sap.

The **centrosome** or cell center can be seen in all animal cells and in some lower plants. Its size is from 0.4 to 0.9 microns.

A centrosome consists of one or two small bodies – centrioles.

The centrosome is involved in the formation of the achromatin spindle (mitotic apparatus), which provides the movement of chromosomes to the opposite poles of the cell.



(A) INTERPHASE CELL

(B) DIVIDING CELL

(C) CILLATED CELL

Some organelles are characteristic only for the special functions of the cells - these are cilia and flagella that perform the functions of movement and protection.

tion.

They are the means by which many microscopic unicellular and multicellular organisms move from place to place. The muscle cells contain special organelles - myofibrils. Under the action of myofibrils, muscle contraction occurs. Some cells contain neurofibrils. They are involved in conducting nerve impulses.

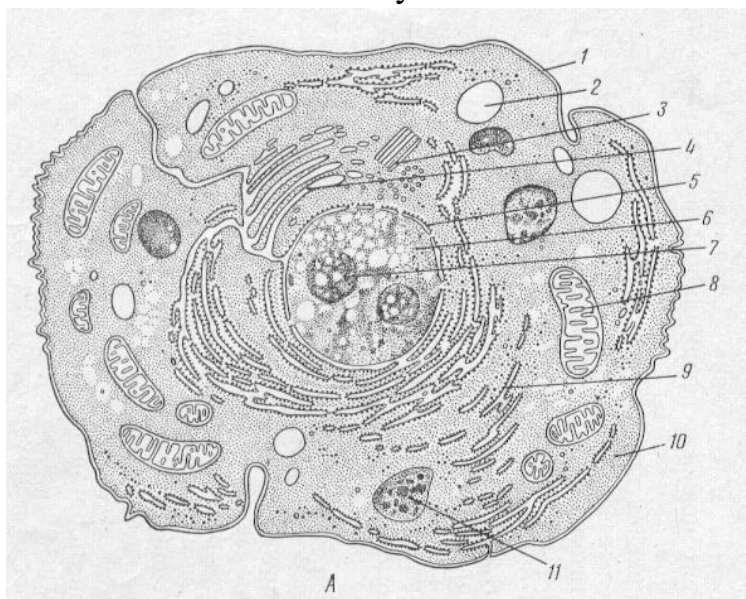
Scheme of the cell structure

A- animal cell;

B- plant cell.

- 1-cell membrane;
- 2-vacuole;
- 3-centrosome;
- 4- Golgi complex;
- 5- nucleus membrane;
- 6-nucleus;
- 7-nucleolus;
- 8-mitochondria;
- 9-ER;
- 10-cytoplasm;
- 11-lysosome;
- 12-chloroplast;
- 13-cell wall;
- 14-ribosome.

Task 3. Do the exercises.



equator	екватор	экватор	équateur	ءاوتسلاطخ
mitotic cycle	мітотичний цикл	митотический цикл	mitotique circuit	لزعمة قروءة
karyokinesis	каріокінез	кариокінез	caryocinèse	ءاونلا ماسقنلا
cytokinesis	цитокінез	цитокінез	cytokinèse	مزلا بوتسلا ماسقنلا

Pay attention!

Arise [verb] arise from/out of

Occur as a result of

New cells arise from preexisting cell by mitosis division.

Task 2. Listen and repeat text.

Text

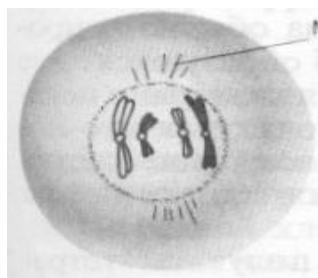
According to the cell theory, all the cells are the results of the division of pre-existing cells. A unicellular organism is divided, forming two new cells. A multicellular organism begins its development from a single cell. All its numerous cells are formed as a result of multiple cell divisions. First, cell division occurs, then they differentiate according to their functions. Tissues are made from cells of a similar type. Organs are made from tissues, and systems are made from several organs working together. In a living organism, old cells die and are replaced by new ones. Thus, the body grows and develops.

There are three types of cell division: 1) **mitosis** - indirect division; 2) **meiosis** - reduction division; 3) **amitosis** - direct division.

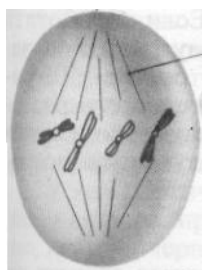
More complex cell division is mitosis. 99% of all cells divide by mitosis. In mitosis a cell divides to form two identical daughter cells. It is important that the daughter cells have copies of every parental chromosome.

Mitosis is a type of cell division in which one cell (the mother) divides to produce two new cells (the daughters). As a result of mitosis, two genetically identical daughter cells are formed with the same set of chromosomes as in the parent cell.

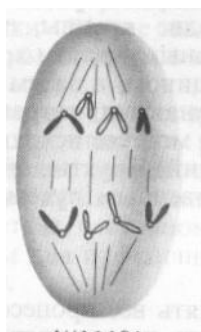
Mitosis is a continuous process that consists of four phases.



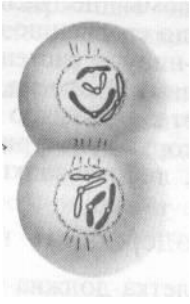
1. **Prophase** is the longest phase of mitosis. The nucleolus and the nuclear membrane disappear, chromosomes are spiralized, an achromatin (mitotic) spindle is formed.



2. **Metaphase** - the mitotic spindle is formed, the chromosomes are located at the equator of the cell.

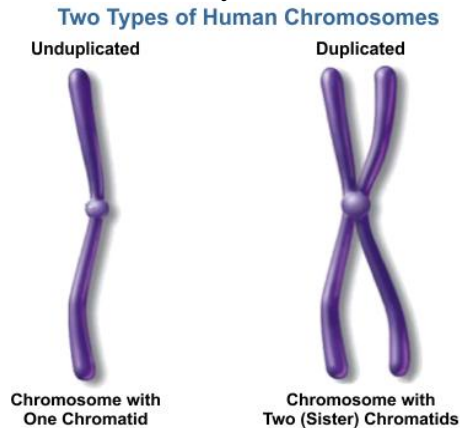


3. **Anaphase** is the shortest phase of mitosis. Daughter chromatids become chromosomes and diverge towards the opposite poles of the cell.



4. **Telophase** - chromosomes diverge to the poles of the cell and then despiralized. A nuclear membrane appears around each set of chromosomes. The division of the nucleus ends. The division of the cytoplasm occurs.

The period between cell divisions is called **interphase**. The period of interphase includes the following events: cell growths, chromosome doubling, tubulin protein synthesis, chromosome reduplication. Each chromosome consists of two chromatids that are connected by a centromere.



As a result of mitosis, two daughter cells are formed with the same set of chromosomes as the parent cell.

The complex of mitosis processes is called **mitotic division**. The period from one cell division to another, which includes mitosis and the interphase period is called the **cell cycle**.

Task 3. Do the exercises.

Exercise 1. Answer the questions.

1. What is mitosis?
2. What is a cell cycle?
3. What is the structure of chromosomes?
4. What happens in the interphase?
5. What is the longest phase of mitosis? What happens in this phase?
6. What happens in anaphase of mitosis?
7. What happens in telophase of mitosis?

Exercise 2. Draw a scheme of mitosis.

Exercise 3. Arrange mitosis events in chronological order:

- a) chromosomes condense: the nuclear membrane disappears;
- b) spindle forms;
- c) chromosomes double;
- d) chromosomes placed at opposite poles of the cell;
- e) chromosomes are arranged along the equator;
- f) cytoplasm is divided.

Class 8. Cell division. Meiosis. Amitosis.

Task 1. Listen, repeat and read words and phrases:

reduction	редукційний	редукционный	détendeur...	ضفاخ، ضيفختا
decrease	зменшення	уменьшение	décroissance	لبلقتة
increase	збільшення	увеличение	accroissement	ريبكتة
diploid	диплоїдний	диплоидный	diploïde	ي جوز
haploid	гаплоїдний	гаплоидный	haploïde	ي داخا
locate	розташовуватися	располагаться	disposer	بتر، فصد
chromatid	хроматида	хроматида	chromatide	ديتامورك
convergence	зближення	сближение	rapprochement	بارتقا
conjugation	кон'югація	конъюгация	conjugaison	إقتران (نوع من التكاثر الجنسي)
crossing-over	кросинговер	кроссинговер	crossing-over	رباعت، روبع
tetrad	тетрада	тетрада	tétrade	ي عابر
centromere	центромера	центромера	cinétochore	المتضيق من الكروموسوم عز جلا (ريمورتنسلا)
centriole	центріоль	центриоль	corpuscule central	لويرتنسلا
bivalent	бівалент	бивалент	bivalent	ي فصد
homologous	гомологічний	гомологичный	homologue	رطانت، لثامد
region	ділянка	участок	aire	عز ج، عاطقة
area/plane	площина	плоскость	plan	ي وتسم
paired	парний	парный	bigéminé	ي جوز
split/separate	розділятися	разделяться	se ramifier	رطشنا، مسقنا
constriction	перетяжка	перетяжка	étranglement	بحد، دش
maternal cell	материнська клітина	материнская клетка	maternel	مأ تیلد
daughter cell	дочірня клітина	дочерняя клетка	cellule fille	تدیلو تیلد
cartilage	хрящ	хрящ	cartilage	فورضغ
tendon	сухожилля	сухожилие	tendon	رتو
liver	печінка	печень	foie	ديك
leukocyte	лейкоцит	лейкоцит	leucocyte	عاضيب مد تيرك

Pay attention!

Disappear [verb] (not see)

to become impossible to see

The nuclear membrane and nucleolus both disappear during prophase of mitosis and meiosis.

Task 2. Listen and read text.

Text

Meiosis is the special type of recombinative and reductive cell division occurring only in the generation of the **gametes** or **germ cells** (eggs and sperm) and in the formation of spores in plants.

In the process of meiosis, the number of chromosomes in the gametes is halved. Gametes contain two times less chromosomes than all other cells in the body. During fertilization, the number of chromosomes doubles as a result of fusion of sperm and eggs.

In meiosis, four male haploid cells are formed from a single diploid cell. During meiosis, two types of division occur: meiosis I and meiosis II. In the first meiotic division, the number of chromosomes is halved. Such a division is called **reduction**.

The first meiotic division consists of four phases: prophase I, metaphase I, anaphase I, telophase I.

The most complex changes occur in prophase I.

Homologous chromosomes (identical in size and shape) are parallel to each other, then get closer and contact. This process is called **conjugation**.

Conjugating chromosomes are called **bivalents** or **tetrads**. Each bivalent consists of four chromatids that are connected by one centromere.

The centrosome is divided into two centrioles, which begin to move to opposite poles of the cell. A fission spindle is formed between centrioles, which consists of microtubules. Then the nuclear envelope is fragmented in the cell.

The homologous chromosomes diverge from each other, intersect with other chromatids and form chiasmata. **Chiasma** is the place of connection of chromatids of different chromosomes. There is an exchange of homologous regions of chromosomes - genes. The exchange process is called **crossing-over**.

At the end of prophase I, chromosomes thicken and spiralize, and chromatids are connected to each other only at several points.

In metaphase I, bivalents of chromosomes are located in the equatorial plane. The spindle division is forming.

In anaphase I, bivalents begin to divide into homologous chromosomes, each of which consists of two chromatids. Homologous chromosomes diverge to the opposite poles of the cell. Thus, in this phase there is a reduction in the number of chromosomes by half (reduction).

The telophase I is the shortest phase of the first meiotic division. The nuclei of daughter cells with a haploid set of chromosomes are formed.

Cytokinesis does not always follow telophase, and the second meiotic division begins immediately.

Meiosis II occurs as a type of mitosis and is called **equational division**.

This type of division also has four phases: prophase II, metaphase II, anaphase II, telophase II.

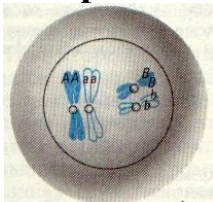
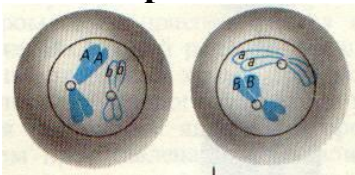
In prophase II, the nucleus contains a haploid set of chromosomes and each chromosome consists of two chromatids.

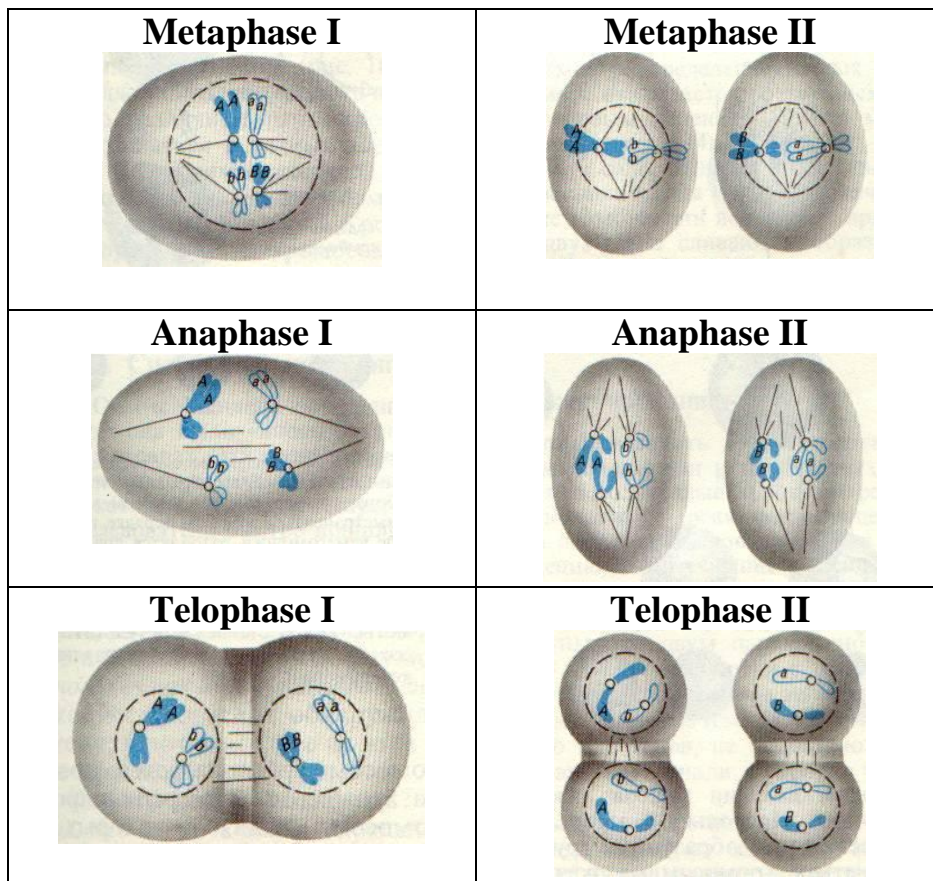
In metaphase II, chromosomes are located at the equator of the cell and the achromatin spindle is formed.

In anaphase II, paired chromatids diverge towards the opposite poles of the cell.

In telophase II, chromosomes despiralize. A nuclear membrane forms around them, and a nucleolus appears in the nucleus.

Meiosis

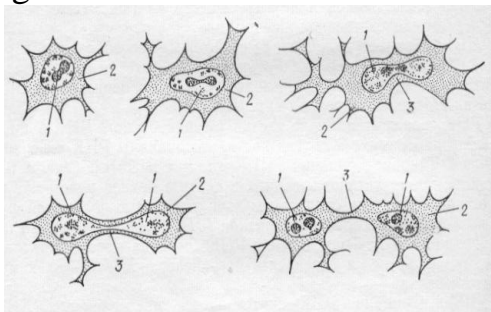
First meiotic division	Second meiotic division
<p>Prophase I</p> 	<p>Prophase II</p> 



Amitosis is a direct cell division characterized by simple cleavage of the nucleus without the formation of chromosomes. Amitosis begins with the division of the nucleus, and then the cytoplasm of the cell. At the beginning of the division, the nucleus is drawn out and a constriction is formed on it, which divides the nucleus in half. Amitosis occurs without formation of spindle fibres. Amitosis is a direct division of a relatively small percentage of cells.

When nuclei are divided into several nuclei, multinucleated cells are formed, and when cells are fused, **symplasts** (the inner side of the plasma membrane) are formed.

As a result of amitosis, daughter cells are formed from the mother cell without altering cellular structures.



Amitosis

- 1 - nucleus;
- 2 - cytoplasm;
- 3 - constriction.

Amitosis is a type of asexual reproduction, which occurs in unicellular organisms such as bacteria, protozoans, pathological cells, old cells, mammalian cartilage cells as well as in fetal membranes, unicellular fungi like yeast. Amitosis is found in both single-celled and multi-cellular animals and plants. For example, in animals, amitosis occurs in the liver.

Task 3. Do the exercises.

Exercise 1. Answer the questions.

1. What is meiosis?
2. What is formed during meiosis?
3. What happens during the reduction division?
4. What is conjugation?
5. What is crossing-over?
6. What is chiasma?
7. What chromosomes are called homologous?
8. What happens in anaphase I?
9. What happens during equational division?
10. What happens in telophase II of meiosis?
11. From where do new cells arise?
12. What happens as a result of cell differentiation?
13. What types of cell division do you know?
14. What is amitosis?
15. What happens in the amitosis process?

Exercise 2. Explain the meaning of the words:

conjugation, crossing over, chiasma, chromatid, bivalent chromosomes.

Exercise 3. Draw a scheme of meiosis.

Class 9. Spermatogenesis and Oogenesis.

Task 1. Listen, repeat and read words and phrases:

spermatogenesis	сперматоґенез	сперматоґенез	spermatogenèse	تغيرونما تاناويحلا نيوكتة تيلمع
oogenesis	оогенез	оогенез	oogenèse	تندلا تاضيوبلا نيوكتة تيلمع تيو
spermatogonia	сперматоґонії	сперматоґонии	cellule spermatique	تغيرونم تيلخ
oocyte	ооцит	ооцит	ovocyte	تغيروندلا تاضيوبلا تيلخ
polar body	полярні тільця	полярные тельца	corpuscule polaire	يبطة ميسج
subsequent/following	наступний	последующий	subséquent	تأ، قحلا
reach	досягати/досягнути	достигать/достигнуть	atteindre	يأعلا دحلا غلب
embryo	зародок	зародыш	embryon	نيدج

Pay attention!

Fuse [verb] [no object] (of group of cellular structure) join or coalesce

Fertilization occurs when the nucleus of both a sperm and an egg fuse to form a diploid cell, known as zygote.

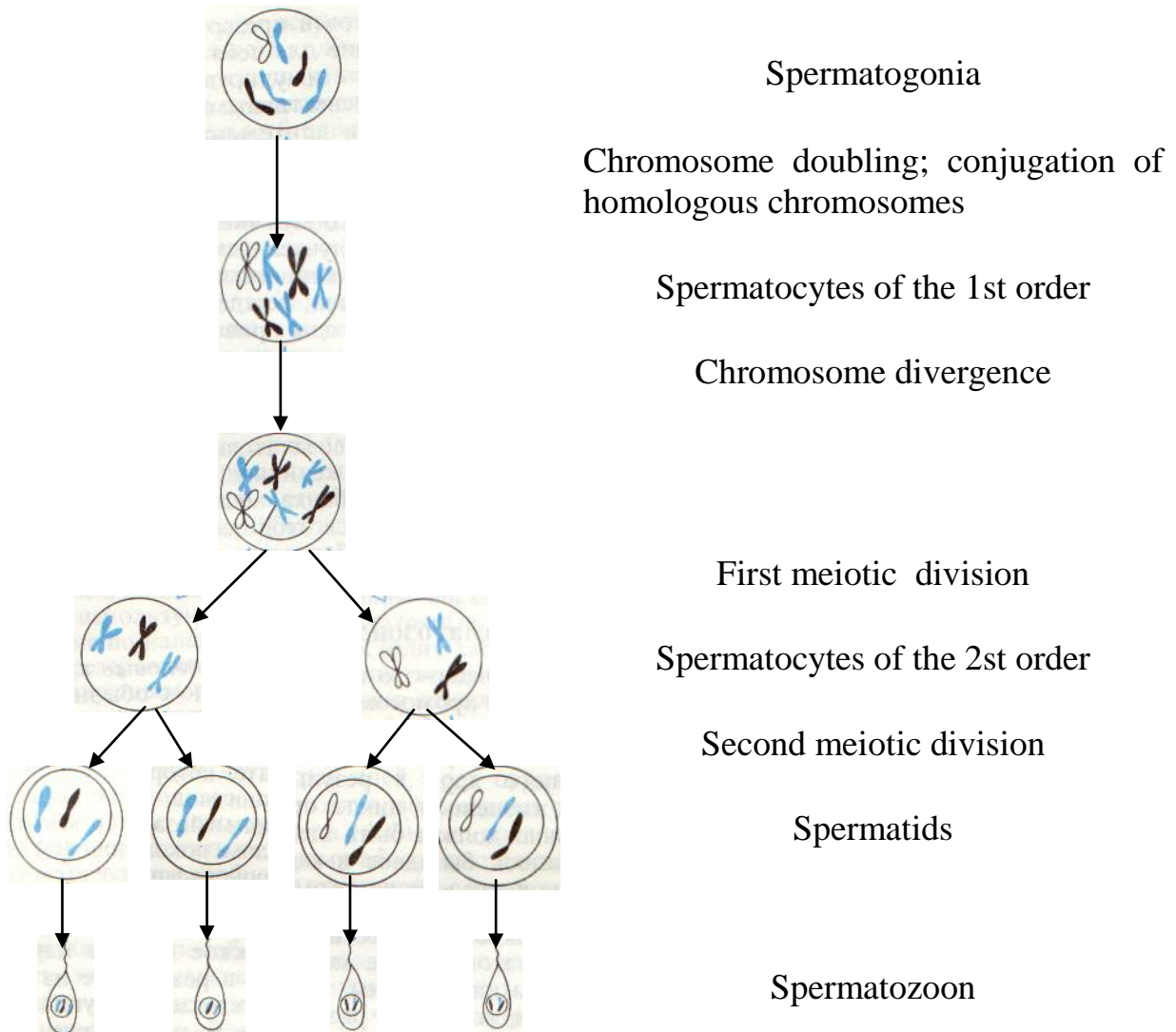
Task 2. Listen and read text.

Text

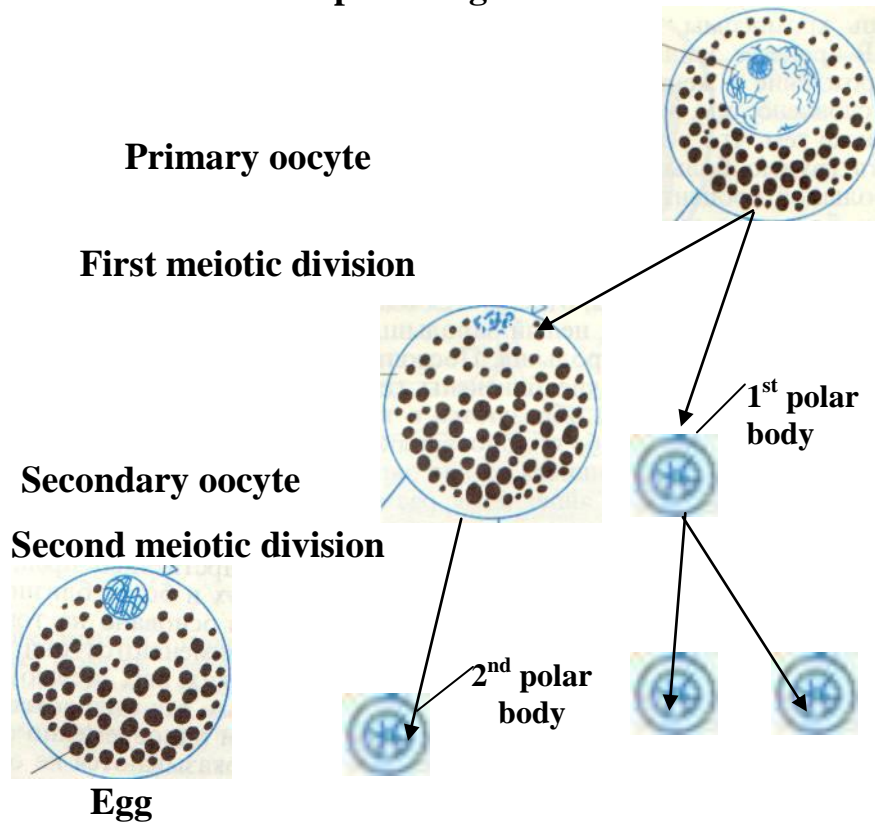
Eggs and spermatozoa are gametes containing half (haploid, n) set of chromosomes compared to somatic cells. When the egg cell is fused with the sperm cell in the fertilized egg, the normal (diploid, $2n$) set of chromosomes is restored.

Meiosis is a specialized type of cell division of the cell nucleus that reduces the chromosome number by half the original amount of genetic information. Thus, in the life cycle of sexually reproducing organisms, this stage is necessary because the number of chromosomes in the body with each generation would be doubled.

Spermatogenesis is the process of formation of spermatozoa. The cells of the testes of the male genital glands, from which sperm cells are formed, are called spermatogonia. Spermatogonia are transformed into spermatocytes of the first order. As a result of two subsequent meiotic divisions, second-order spermatocytes are formed first, and then spermatids. Spermatids mature and turn into spermatozoa.



Spermatogenesis



Oogenesis

The process of formation of oocytes differs significantly from the process of formation of spermatozoa.

The process of formation of eggs is called **oogenesis**. During oogenesis, two meiotic divisions also occur. With each division, most of the cytoplasm moves into one of the daughter cells, which is called an oocyte. As a result of the first meiotic division, a primary oocyte and one polar body (reduction body) are formed.

After the second meiotic division, one large egg cell and three small cells, the polar bodies, develop. The egg cell is the main source of nutrients, ribosomes, and other components of the cytoplasm necessary for the early stages of embryo development. The polar bodies are quickly dying.

Oogenesis results in one large cell (egg or ovum) and three small cells (polar bodies).

Thus, meiosis is a process where a single cell divides twice to produce four cells containing half the original amount of genetic information.

Task 3. Do the exercises.

Exercise 1. Answer the questions.

1. What happens when an egg is fused to a sperm cell?
2. What is spermatogenesis?
3. What happens during spermatogenesis?
4. What is oogenesis?
5. What happens during oogenesis?

Exercise 2. Complete these sentences.

Eggs and spermatozoa are gametes containing ... (..., n) set of chromosomes compared to ... cells. Meiosis is a process where a single cell divides ... to produce ... cells containing half the original amount of genetic information.

Class 10. General histology.

Task 1. Listen, repeat and read words and phrases:

histology	гістологія	гистология	histologie	تجسناً لهء
complex	комплекс	комплекс	complexe	دقعم
similar/analogous	подібний	сходный	homologue	بهببء، لءامم
definite	певний/визначений	определенный	déterminé	نرعمء، دءءم
integumentary	покривний	покровный	tégumentaire	عطاءء (ما ررطر الربرم)
sense organs	органи чуття	органы чувств	les organes des sens	سءلاء اءءعاً
epithelial tissue	епітеліальна тканина	эпителиальная ткань	tissu épithélial	رءلاط ءرررء
connective tissue	сполучна тканина	соединительная ткань	tissu conjonctif	مءءء ءرررء
muscular tissue	м'язова тканина	мышечная ткань	tissu musculaire	رءءءء ءرررء
nervous tissue	нервова тканина	нервная ткань	tissu nerveux	رءبءءء ءرررء

Pay attention!

Bind [verb] (tie)

to tie something tightly, or to fasten things together

Connective tissue binds other tissues of the body.

Act [verb] (do something)

to take action

Tissue is a group of cell that act together to carry out a specific function in the body.

Task 2. Listen and read text.

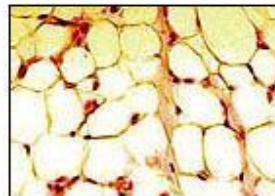
Text

The body of multicellular animals and humans consists of a large number of cells and extracellular substance, forming various tissues that form organs.

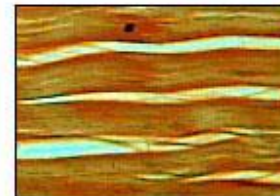
Complexes of cells and intercellular substance, similar in structure, function and origin, form certain types of tissue.



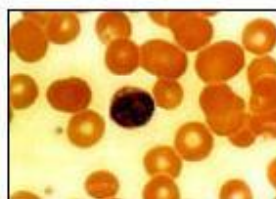
Areolar connective tissue



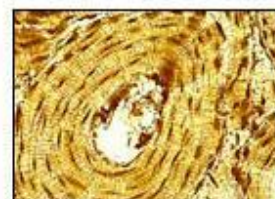
Adipose tissue



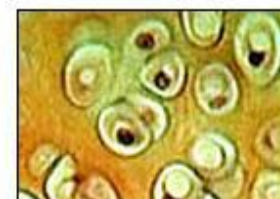
Fibrous connective tissue



Blood



Osseous tissue



Hyaline cartilage

Human body tissue

Tissues are groups of cells and intercellular substances that have a similar structure and act together to perform a specific function.

Tissues form organs; groups of organs are organ systems. The following main organ systems are distinguished: bone (skeletal), muscular, circulatory, respiratory, digestive, excretory (urinary), reproductive, nervous, sensory system, endocrine, integumentary (skin). Each tissue has its own characteristics, but in the body all tissues

are closely related to each other. There are four types of animal tissue: - epithelial; - endocrine secretion; - muscle; - nervous.

Task 3. Do the exercises.

Exercise 1. Answer the questions.

1. What is the body of multicellular animals and humans consists of?
2. What is tissue?
3. What organ systems form tissues? What types of animal tissue do you know?
4. What is the name of science that deals with tissue?

Exercise 2. Compose the text plan.

Class 11. Epithelial tissue.

Task 1. Listen, repeat and read words and phrases:

line	вистилати	выстилать	daller	ن طب
flat epithelium	плоский епітелій	плоский эпителий	épithélium squameux	قر اھظ چیسند (تیحطسد و سکی احطسد)
cuboidal epithelium	кубічний епітелій	кубический эпителий	épithélium cubique	بعکم چیسند
single-layered epithelium	одношаровий епітелій	однослойный эпителий	épithélium monostratifié	یداحأ چیسند
multilayered/stratified epithelium	багатошаровий епітелій	многослойный эпителий	épithélium polystratifié	ی قبط چیسند
cylindrical epithelium	циліндрічний епітелій	цилиндрический эпителий	épithélium cylindrique	ی ناوطسا چیسند
ciliated epithelium	миготливий епітелій	мерцательный эпителий	épithélium cilié,	بدھم چیسند
mucous membrane	слизова оболонка	слизистая оболочка	membrane muqueuse	ی طاخمه عاشد
serosa	серозна оболонка	серозная оболочка	membrane séreuse	ی لصم عاشد
gland/glands	залоза, -и	железа, -ы	glande	قدغ
adjoin each other	прилягають один до одного	прилегают друг к другу	adhérent	محازت، ضعبی مضعبی قصلتلا
layer	шар	слой	couche	تقبط
absorption	всмоктування	всасывание	absorption	ص اصتملا
discharge/excretion	виділення	выделение	émission	زرفم
drying	висихання	высыхание	dessiccation	فیفجت
secretion/secretum	секрет	секрет	sécréta	زارفا
kidney	нирка	почка	rein	تیلک
corneous	роговий	роговой	couche cornée	تینرقة
skin	шкіра	кожа	cutis	دلج
cover	вкривати	покрывать	abriter	یاط، یطغ

Pay attention!

Take part [phrase]

join in activity; be involved

Tissues take part in growth by formation of new cells.

Classify [verb] with object

arrange (a group of people or things) in classes or categories according to shared qualities or characteristics.

Tissues are classified into four main categories – epithelial, connective, muscle and nervous tissues.

Task 2. Listen and read text.**Text**

Epithelial tissues cover the body from the outside, lining the mucous and serous membranes of internal organs and form the majority of glands.

Epithelial tissues consist of cells that fit tightly together and form one or more layers. Between the layers of epithelial cells is the tissue fluid.

There are two principal types of epithelium: **covering** and **glandular**.

Covering epithelium are sheets of tissue that cover the external surfaces (skin, lungs, gut) and line the internal cavities (blood and lymphatic vessels, pleura) of the body. The covering epithelia separates the body from the external environment, takes part in the metabolism, in the absorption of substances and the release of metabolic products.

Some epithelia, called **glandular epithelia**, absorb or secrete chemical solutions. For example, the glandular epithelia that line the lumen (cavity) of digestive and respiratory tract form a mucous membrane.

According to the form and function of cells, the epithelium can be: **single-layered** (consists of one layer of cells);

multilayered (stratified) (consists of several layers of cells);

ciliated (ciliate) - if there are cilia on the surface of the cells.

According to the shape of the cells, the epithelium can be: **flat, cuboidal, cylindrical** (prismatic); **ciliated**.

Glandular cells are related to glands, and glands are related to secretion of any chemical substance (hormones and enzymes), so glandular cells serve in secretion.

Epithelial tissues line the outer surfaces of organs and blood vessels throughout the body, as well as the inner surfaces of cavities in many internal organs. An example is the epidermis, the outermost layer of the skin. Through the epithelium, there is a metabolism between the body and the environment. The epithelium of the digestive system is involved in absorption and in the enzymatic digestion of food to amino acids, fatty acids, monosaccharides.

The epithelium of the kidneys and skin takes part in the removal of the products of cell metabolism. Thus, the functions of epithelial cells include secretion, selective absorption, protection, transcellular transport, and sensing.

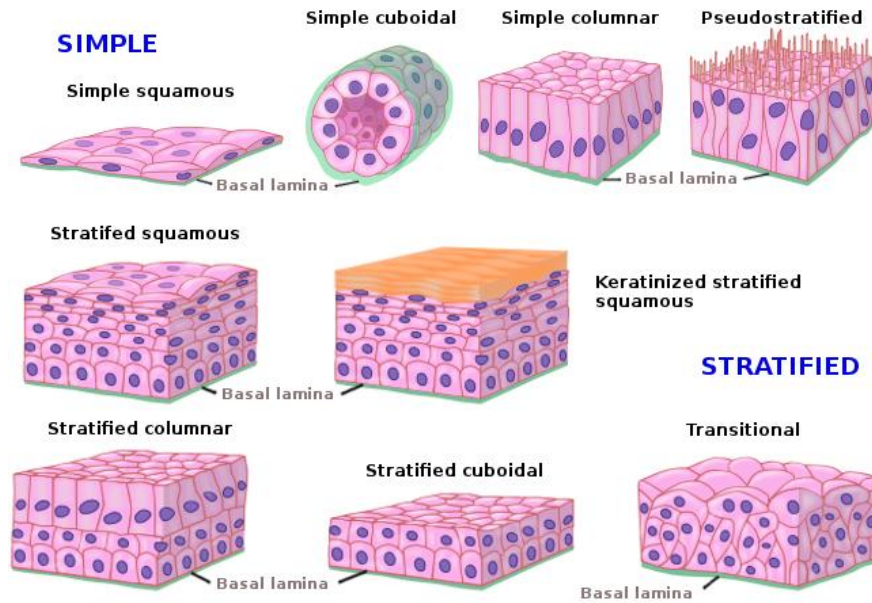
Types of epithelial tissue**Task 3.** Do the exercises.

Exercise 1. Answer the questions.

1. What is epithelial tissue?
2. What types of epithelial tissue do you know?
3. How the epithelium is distinguished by the shape of the cells?
4. What are the functions of the glandular epithelium?
5. What are the functions of the covering epithelium?

Exercise 2. Compose the text plan.

Exercise 3. Draw the types of epithelium in the notebook.



Class 12. Connective tissue.

Task 1. Listen, repeat and read words and phrases:

ligament	зв'язка	связка	ligament	طابر، رتو
interlayer	прошарок	прослойка	couche	ن يئقبط نييد
reticular tissue	тканина сполучна ретикулярна	ткань соединительная ретикулярная	tissu réticulé	ماضد ي كيشد چيسند
spongy tissues	тканина сполучна пухка	ткань соединительная рыхлая	tissu cribriforme	ماضد يوخر چيسند
fibrous tissue	тканина сполучна волокниста	ткань соединительная волокнистая	un tissu fibreux	ماضد ي فيلا چيسند
cartilaginous tissue	тканина хрящова	ткань хрящевая	tissu cartilagineux	ي فورصدغ چيسند
bone [osseous] tissue	тканина кісткова	ткань костная	tissu osseux	ي مطء چيسند
spindle cell	клітина веретено-подібна	клетка веретенообразная	cellule fusiforme	تيلز غم تيلذ
stellate cell	клітина зірчаста	клетка звездчатая	cellule stellaire	تيمجد تيلذ
elastic fibers	волокна еластичні	волокна эластические	fibre élastique	تترم فايلا
reticular fiber	волокна ретикулярні	волокна ретикулярные	fibre de réticuline	تیکيشد فايلا
tendon	сухожилля	сухожилие	tendon	رتو
spine/vertebra	хребет	позвоночник	colonne vertébrale	يرقفء دومء
vertebra	хребець(хребці)	позвонок(позвонки)	vertèbre	يرقفءا دومءا نم ءرقفء
bundle/bunch	пучок	пучок	cordon	تمزد

Pay attention!

Bind [verb], bound

to tie something tightly or to fasten something

Connective tissue functions mainly to bind and support other tissue.

Task 2. Listen and read text.

Connective tissue takes part in the formation of ligaments and interlayers between organs.

Some types of this tissue (blood, lymph) carry substances throughout the body inside the blood and lymphatic vessels.

All kinds of connective tissue have a large amount of intercellular substance.

There are several types of tissues of the internal environment:

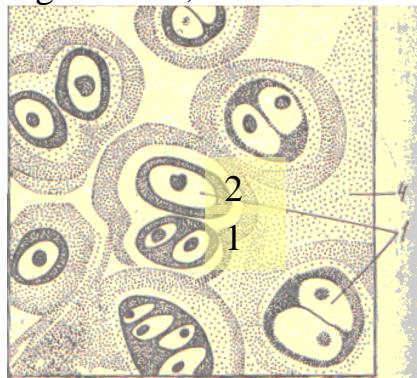
- **connective tissues** (reticular tissue, spongy tissue, dense fibrous tissue, adipose tissue);
- **supporting tissues** (cartilaginous tissue, bone tissue);
- **blood and lymph.**

Reticular tissue consists of stellate cells, which are connected to each other by appendages. Between the cells there is the intercellular substance and the reticular fibers.

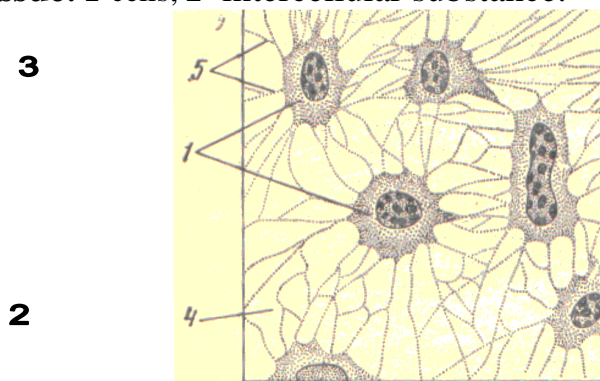
Spongy tissue consists of stellate and spindle-shaped (elongated) cells (about 10 different species), collagen and elastic fibers. It forms interlayers between organs.



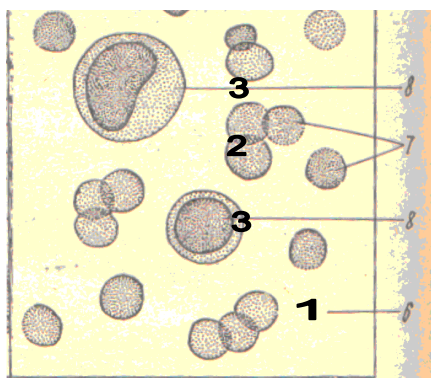
Spongy tissue: 1-cells; 2-collagen fibers; 3-elastic fibers; 4- intercellular substance.



Cartilaginous tissue: 1-cells; 2- intercellular substance.



Bone tissue: 1-cells; 2-intercellular substance; 3-channels between cell.



Blood: 1-blood plasma; 2-red blood cells; 3-white blood cells.

A dense fibrous tissue consists of bundles of collagen fibers and a small number of cells (fibroblasts). It forms ligaments and tendons, skin dermis.

Adipose tissue consists of fat cells (myocytes). It is located between the organs and under the skin, forming subcutaneous adipose tissue.

Cartilaginous tissue consists of round or oval cells and a dense intercellular substance. It covers the epiphyses of the bones of the skeleton, is part of the nose, ear, trachea, connects the vertebrae.

The intercellular substance of the bone tissue consists of collagen fibers, salts, calcium and other substances. The intercellular substance has the form of plates. In these plates there are channels, permeated through the appendages of bone cells.

Task 3. Do the exercises.

Exercise 1. Answer the questions.

1. What kinds of connective tissue do you know?
2. What is the structure of reticular tissue?
3. What does a spongy tissue consist of? What does it form?
4. What does dense fibrous tissue consist of? What does it form?
5. What is the structure of cartilaginous tissue?

Exercise 2. Compose the text plan.

Exercise 3. Draw the types of connective tissues in the notebook.

Class 13. Connective tissue. Blood and lymph.

Task 1. Listen, repeat and read words and phrases:

lymph	лімфа	лимфа	lymphe	فمیللا
plasma	плазма	плазма	plasma	امزلابلا
blood serum	сироватка крові	сыворотка крови	sérum sanguin	مدلا لصم
leukocyte	лейкоцит	лейкоцит	leucocyte	ءاباضیلا مدلا تايرك
platelet/ thrombocyte	тромбоцит	тромбоцит	thrombocyte	تیرمد تحیفص
erythrocyte	еритроцит	эритроцит	érythrocyte	ءارمطا مدلا تايرك
bone marrow	кістковий мозок	костный мозг	moelle	مظعلا عاخذ
anemia	анемія	анемия	anémie	فقر الدم (الأنيميا)
blood coagulation	згортання крові	свертывание крови	inopexie	مدلا رثخت
lymphocyte	лімфоцит	лимфоцит	lymphocyte	تیمفیللا تیلخ

Pay attention!

carry [verb] transport

to hold something and transport it

Red blood cells carry oxygen.

defense [noun] protection (British defence)

protection or support against attack, or infection

White cells function in defense against viruses, bacteria, and other invaders.

Task 2. Listen and repeat text.

Text

Blood and lymph are fluid connective tissue. It consists of a liquid intercellular substance called plasma, and blood cells.

Blood plasma is a colloidal solution of salts and proteins in water. Blood plasma, released from proteins, is called **serum**.

Blood elements are divided into three main groups:

- white blood cells - **leukocytes**;
- red blood cells - **erythrocytes**;
- blood platelets or **thrombocytes**.

Most of the white blood cells are involved in protecting the body from disease. Some white blood cells can multiply after leaving the bone marrow. There are many different types of white blood cells, but almost all of them have a protective function. Feature of leukocytes is the ability to move. Leukocytes are formed in the red bone marrow, spleen, lymph nodes, thymus.

Red blood cells are the most numerous blood cells. They make up 99.9% of all blood cells. Their main function is oxygen transport.

A high red blood cell count is an increase in oxygen-carrying cells in our bloodstream. Red blood cells transport oxygen from your lungs to tissues throughout your body. Red cells remain viable for only about 4 months before they are removed from the blood and their components recycled in the spleen. Red blood cells are formed in the red bone marrow. Without adequate iron, the body cannot produce enough hemoglobin for red blood cells. The result is iron-deficiency anemia.

Platelets are nuclear-free formation with a diameter of 2-5 microns. Platelets or thrombocytes are a component of blood whose function is to react to bleeding from blood vessel injury. They are formed in the red bone marrow and then destroyed in the spleen. Platelets are involved in blood coagulation processes.

Lymph is formed by the passage of substances from blood capillaries into tissue spaces. Lymph contains lymphocytes (white cells that fight infection) and protect the blood against bacteria and harmful substances.

Task 3. Do the exercises.

Exercise 1. Compose a text plan.

Exercise 2. Answer the questions.

1. What does blood consist of?
2. What types of blood cells do you know?
3. What are the functions of red blood cells?
4. What are the functions of leukocytes?
5. What are the functions of platelets?
6. Where are red blood cells formed and destroyed?
7. Where are leukocytes cells formed and destroyed?
8. Where are thrombocytes formed and destroyed?
9. What are the functions of lymph?

Exercise 3. Explain the meaning of words:

erythrocyte, leukocyte, platelet, blood plasma, serum, lymphocyte, anemia.

Class 14. Muscle tissue.

Task 1. Listen, repeat and read words and phrases:

contraction	скорочення	сокращение	raccourcissement	ضابقتا
contract/shrink	скорочуватися	сокращаться	contractibilité	ضبقنا
provide	забезпечити	обеспечивать	accommoder	رفو،نأ،نمض
locomotion/movement	пересування	передвижение	locomotion	أثر حتم
contractile	скоротливий	сократительный	contractilité	ضبقنم
myofibril	міофібрілла	миофибрилла	myofibrille	میلضءة أفیلا
smooth muscular tissue	гладка м'язова тканина	гладкая мышечная ткань	tissu musculaire lisse	س لماً ی لضعء چیسذ
transversal striated muscle tissue	поперечносмугаста сердцева м'язова тканина	поперечнополосатая сердечная мышечная ткань	tissu musculaire striée	ی فیوجت/ی بلق ی لضعء چیسذ
transversal skeletal muscle tissue	поперечносмугаста скелетна м'язова тканина	поперечнополосатая скелетная мышечная ткань	tissu musculaire striée	ی لکیه ی لضعء چیسذ
sarcolemma	сарколема	сарколемма	sarcolemme	ی لضعء رادچ
strip	смуга	полоса	strie	أحیرش، طیرش
tongue	язик	язык	langage	ن اسل
pharynx	глотка	глотка	pharynx	موعلذ
heart	серце	сердце	cœur	بلق
musculature	м'язи/мускулатура	мускулатура	musculature	ی لضعءا زاهجلا

Pay attention!

compose [verb] (form)

to be formed from various things

Muscle tissue is composed of long cells called muscle fibers.

Task 2. Listen and repeat text.

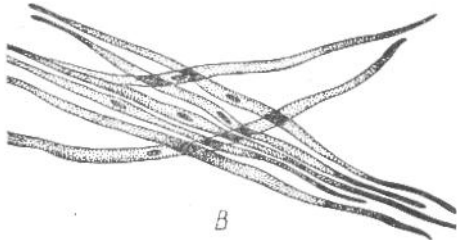
Text

Muscle tissue forms the muscles of animals and humans. It can contract (means muscle shortening), which ensures the locomotion of animals and humans and the movement of parts of their bodies.

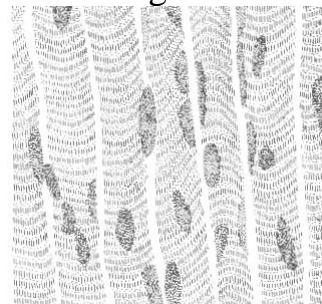
In the cytoplasm of muscle cells there are special contractile threads - **myofibrils**.

There are two types of muscle tissue: smooth and striated.

Smooth muscle tissue consists of narrow spindle-shaped cells with a single, centrally located nucleus and contains many longitudinal myofibrils. In higher animals and in humans, this tissue forms the walls of abdominal organs.



Smooth muscle fibers



Striated muscle tissue

The **striated muscle tissue** consists of thick fibers 10–12 cm long. The muscle fibers of this tissue is lined or covered by a plasma membrane called the sarcolemma. Under the membrane there is the cytoplasm with a large number of nuclei and con-

tractile structures - myofibrils. On the myofibrils of this tissue, dark and light stripes are alternately arranged. Therefore, the tissue is called striated

The striated muscle tissue forms the whole skeletal muscles, the muscles of the tongue, and the pharynx. Special - striated - muscle tissue forms the heart membrane - myocardium.

During contractions, a striated muscle is extended by the action of muscles. All striated muscles are attached to some component of the skeleton, unlike smooth muscle, which composes hollow inner organs such as the intestines or blood vessels.

Task 3. Do the exercises.

Exercise 1. Compose a text plan.

Exercise 2. Answer the questions.

1. What is the main property of muscle tissue?
2. What types of muscle tissue do you know?
3. What is the characteristics of smooth muscle tissue?
4. What is the characteristics of striated muscle tissue?
5. What forms smooth muscle tissue?
6. What forms striated muscle tissue?

Exercise 3. Explain the meaning of words: myofibril, sarcolemma.

Exercise 4. Draw the type of muscle tissue.

Class 15. Nervous tissue.

Task 1. Listen, repeat and read words and phrases:

neuron	нейрон	нейрон	neurocyte	نبيضة عصبية
neuroglia	нейроглія	нейроглія	tissu glial	خمسلا ایلاخن م عود
dendrite	дендрит	дендрит	dendrite	زائدة شجرية (في الخلية العصبية)
axon	аксон	аксон	axone	نبيصعا عصبیلا روحم
neurite	нейрит	нейрит	neurite	ببصعلا روحم
appendage	відросток	отросток	appendice	عوتد
neuron	уніполярний нейрон	униполярный нейрон	dendritique	
bipolar neuron	біполярний нейрон	биполярный нейрон	bipolaire unipolaire	نبيطقة تاذا نبيصع
multipolar neuron	мультиполярний нейрон	мультиполярный нейрон	neurone multipolaire	باطقلا تددعتم نبيصع
branch out	галузится	ветвиться		ببعشت، عرفد،

Pay attention!

specialize [verb]

doing one type of work

The neuron, or nerve cell, is uniquely specialized to transmit nerve impulses.

concentrate [verb] (come together)

to bring or come together in a large number or amount in one particular area

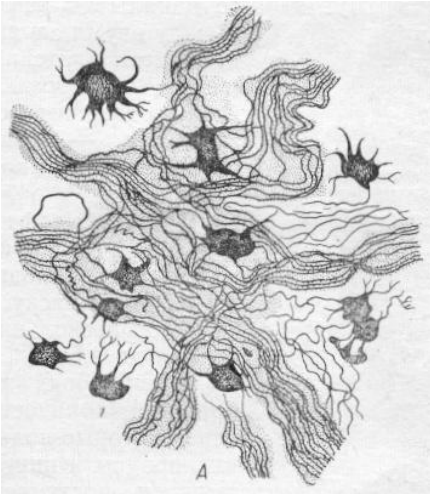
In many animals, nervous tissue is concentrated in the brain.

Task 2. Listen and repeat text.

Text

Nerve tissue consists of nerve cells, or **neurons**, and **neuroglia**.

Nervous tissue



The form of neurons depends on the number of processes departing from it. A neuron that has one very short process is called a **unipolar neuron**, two processes - a **bipolar**, three processes and more - a **multipolar neuron**.

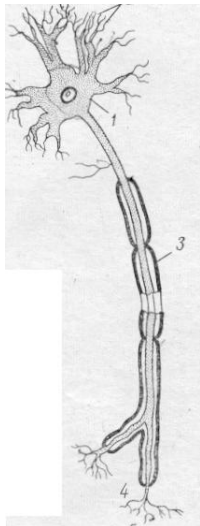
Unipolar neurons are found in spinal nerve cell bodies and cranial nerves. Bipolar neurons are sensory neurons consisting of one axon and one dendrite that extend from the cell body.

There are two types of neurons processes.

Dendrites are short and branching processes on which information enters the neuron. The functions of dendrites are to receive signals from other neurons, to process these signals, and to transfer the information to the body of the neuron.

Neurites or **axons** are long processes that branch only at the ends along which information comes from a neuron. A neuron has several dendrites and one axon.

Axon carries nerve impulses away from the cell body. A neuron typically has one axon that connects it with other neurons or with muscle or gland cells.



- 1-neuron;
- 2-dendrite;
- 3- coated neurite;
- 4-nerve ending.

Dendrites and axons differ not only in structure, but also in their functions.

Dendrites perceive excitation and conduct them to the nerve cell, and neurites transmit a nerve impulse from the cell to other nerve cells and working organs.

The neuroglia performs nutritional, support, protective functions and consists of cells of various shapes.

Nervous tissue has two main properties - excitability and conductivity.

Excitability is the ability to initiate nerve impulse in response to stimuli (changes outside and inside the body).

The transmission of excitation in a particular direction is called **conductivity**. Conductivity is the ability of nerve tissue to transmit excitement - impulse.

Nervous tissue receives irritation from the external and internal environment and transfers them to the organs of the body: from one organ to another.

Exercises 1. Answer the questions.

1. What are the properties of nerve tissue?
2. What is nerve tissue?
3. What types of neurons do you know?
4. What structure has an axon and what function does it perform?
5. What structure have dendrites and what function do they perform?
6. What are the functions of neuroglia?

Exercises 2. Explain the meaning of words:

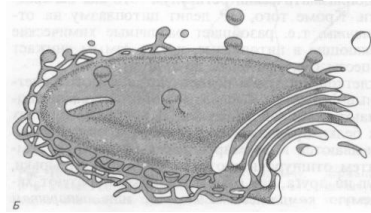
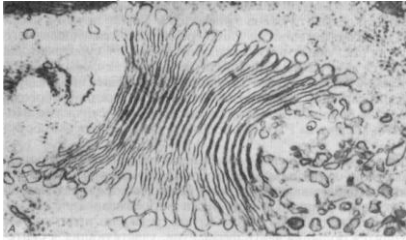
neuron, neuritis, neuroglia, dendrite, axon, excitability, conductivity.

Exercises 3. Sketch a neuron and show its main parts in the picture.**Class 16. Laboratory work №2.****Animal and human tissue.****Class 17. Repetition.****Task 1.** Listen, repeat and read words and phrases:

macroelement	макроелемент	макроэлемент	macro-élément	ريبك رصنع
microelement	мікроелемент	микроэлемент	micro-élément	قېقد رصنع
nucleic acid	нуклеїнові кислоти	нуклеиновые кислоты	acides nucléiques	نېوون ضامحاً
deoxyribonucleic acid (DNA)	дезоксирібонуклеїнова кислота	дезоксирибонуклеиновая кислота (ДНК)	acide désoxyribonucléique	حمض نووي رايبوزي منقوص الأكسجين DNA
ribonucleic acid (RNA)	рибонуклеїнова кислота	рибонуклеиновая кислота	acide ribonucléique	يزوبيارلا يوونلا ضامحاً
mitochondrion (plural is mitochondria)	мітохондрія	митохондрия	acide ribonucléique	اير دنكوتيم
endoplasmic reticulum	ендоплазматичний ретикулум/сітка	эндоплазматический ретикулум/сеть	réticulum endoplasmique	تيملابودنلاً تمكيشلا
achromatin spindle	ахроматинове веретино	ахроматиновое веретено	fuseau achromatique	خيوط مغزلية (تتكون عند انقسام الخلايا)
sarcolemma	сарколема	сарколемма	sarcoleme	ي اضع رادج
myofibril	міофібрила	миофибрилла	myofibrille	تيملاضع تيملا
transversal striated muscle tissue	поперечнозмугаста м'язова тканина	поперечнополосатая мышечная ткань	tissu musculaire strie	ي فيوجت ي اضع جييسن
unipolar neuron	уніполярний нейрон	униполярный нейрон	neurone unipolaire	ببطقلا تيمداحاً تيمصع
bipolar neuron	біполярний нейрон	биполярный нейрон	neurone bipolaire	ن ببطقة تاذا تيمصع
multipolar neuron	мультиполярний нейрон	мультиполярный нейрон	neurone multipolaire	بباطقلاً تيمصع تيمصع
dendrite	дендрит	дендрит	dendrite	زائدة شجرية (في الخلية العصبية)
axon	аксон	аксон	axone	تيمصعلا تيمبلا روحم
neurite	нейрит	нейрит	neurite	ببصعلا روحم
neuroglia	нейроглія	нейроглия	tissu glial	نملا ابلاذن م عون
excitability	збудливість	возбудимость	excitabilité	جييهت، ريثات

Task 2. Answer the questions.

1. What is the study of cells called?
2. What are the basic cell organelles?
3. What organelle is shown in the image below and what functions it performs?



4. What cell organelles are involved in protein synthesis?
5. What organelle contains digestive enzymes?
6. What is the name of the organelle that synthesizes ATP?
7. What is cytoplasm?
8. What organic substances are part of the cell?
9. What are the functions of mineral salts in the cell?
10. What is mitosis?
11. In what phase of mitosis are chromosomes located at the equator of the cell?
12. What is cytokinesis?
13. What happens in the interphase phase of mitosis?
14. What happens in prophase I meiosis?
15. In which phase of meiosis do homologous chromosomes diverge to opposite poles?
16. What types of epithelial tissue do you know?
17. What are the functions of epithelial tissue?
18. What types of muscle tissue do you know?
19. What are the functions of muscle tissue?
20. What types of connective tissue do you know?
21. What are the functions of blood?
22. What blood cells do you know?
23. What are the functions of the lymph?
24. What is the study of tissues called?
25. What are the main properties of nerve tissue?
26. What types of neurons do you know?
27. What functions do the dendrites perform?
28. What function does the nerve tissue perform?

Class 18. Control work №2.