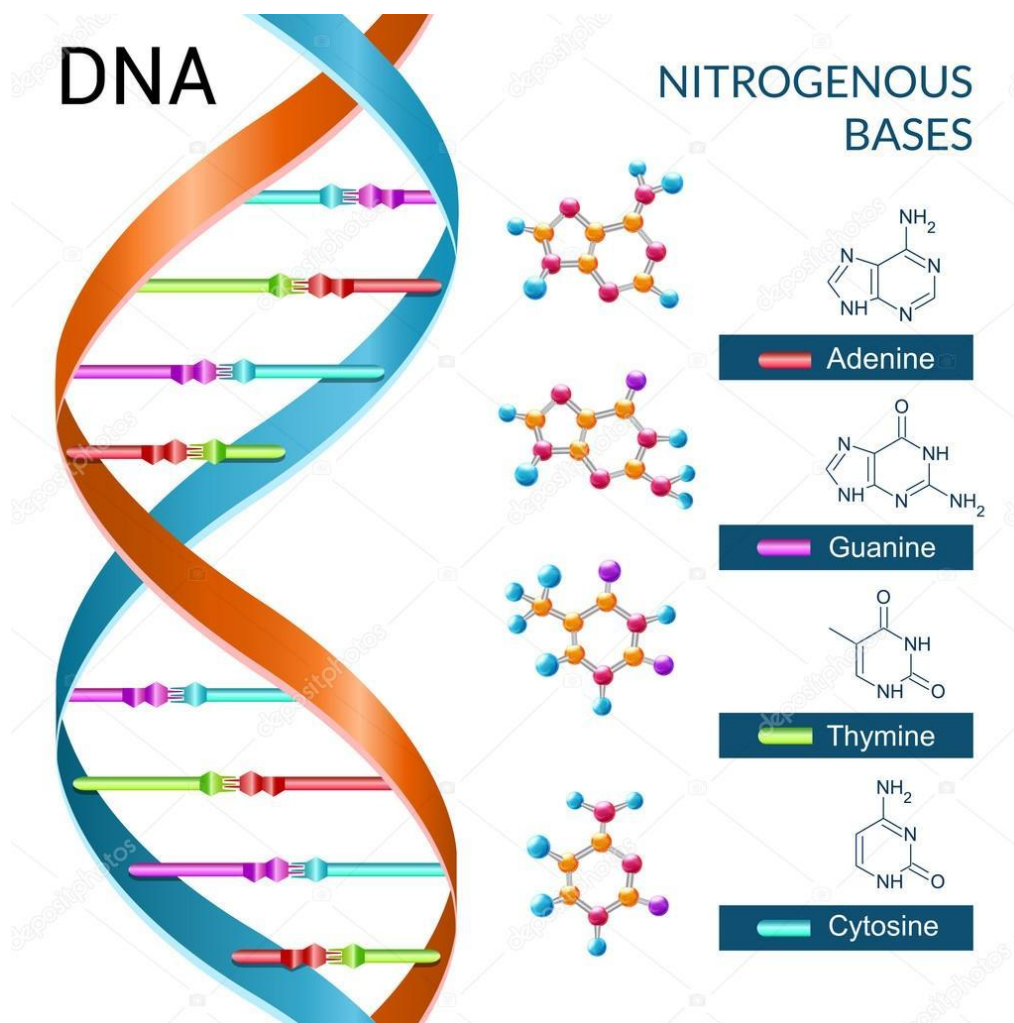


MINISTRY OF PUBLIC HEALTH OF UKRAINE
Ukrainian Medical Stomatological Academy

*Preparatory department for
foreign students*

Basics of general histology and cytology
Study guide for foreign students



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Compiled by: **Krivoruchko Tatyana**, teacher of Department of Bioorganic and Biological Chemistry.

Ovcharenko Oksana, teacher of Preparatory Department for Foreign Citizens.

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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.

Contents

| | | |
|-----------------|---------------------------------------------|----|
| Class 1 | Chemical composition of the cell. | 3 |
| Class 2 | Inorganic substances of the cells and water | 5 |
| Class 3 | Organic substances of the cells | 7 |
| Class 4 | Cell structure | 9 |
| Class 5 | Cell organelles | 11 |
| Class 6 | Laboratory work: «Cell structure» | 14 |
| Class 7 | Cell division. Mitosis | 14 |
| Class 8 | Cell division. Meiosis. Amitosis | 17 |
| Class 9 | Spermatogenesis and Oogenesis | 20 |
| Class 10 | General histology | 23 |
| Class 11 | Epithelial tissue | 24 |
| Class 12 | Connective tissue | 26 |
| Class 13 | Connective tissue. Blood and lymph | 28 |
| Class 14 | Muscle tissue | 30 |
| Class 15 | Nervous tissue | 31 |
| Class 16 | Laboratory work "Animal and human tissues" | 33 |
| Class 17 | Repetition | 33 |
| Class 18 | Control work №2 | 34 |

Class 1. Chemical composition of the cell.

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

| | | | | |
|-----------------|---------------------------|------------------------------|------------------------|-------------------|
| detect / reveal | виявляти, виявити | обнаружи- вать/обнаружить | détecer / localiser | يلاحظ، فشتكا |
| macroelement | макроелемент | макроэлемент, -ы | nutriments, s | ريبك رصء |
| microelemen | мікроелемент | микроэлемент, -ы | oligo-élément, | قيد رصء |
| lipid, s | ліпід | липид, -ы | lipides, | تاينهء |
| lipoid, s | ліпоїд | липоид, -ы | lipoide | تاينهء (تايمحش) |
| 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 | تقرلا دغلا |
| pancreas | підшлункова залоза | поджелудочная железа | pancréas | كنبلا دغلا تيساير |
| hormone, -s | гормон | гормон, -ы | hormono-s | نومره |
| vitamin | вітамін, -и | витамин, -ы | vitamine | نيماتيف |
| pigment | пігмент, -и | пигмент, -ы | pigment | تغصد |
| 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 | ببيزم |
| 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 | لغلغللا |
| semipermeable | напівпрониклий | полупроницаемый, -ая, -ое, -ые | hémiperméable | ذفم بمش |
| salt | сіль | соль, -и | sel | حلم |
| plasma | плазма | плазма | plasma | امزلا بلا |
| irritability | подразливість | раздражимость | irritabilité | جيهتلا لء قليا قلا |
| ratio | співвідношення | соотношение, -ия | quotient | طبارت بسانت قيس |
| concentration | концентрація | концентрация, -ии | concentration | زيركتلا |
| buffer properties | буферні властивості | буферные свойства | tampon caractères, | خففختلا قيصا |
| buffering | буферність | буферность | effet tampon | ففختلا لء قليا قلا |
| strength/stability | міцність | прочность | solidité | قوتولا |
| ion | іон | ион, -ы | ion | نویا |
| cation | катіон | катион, -ы | cation | بجوم نویا |
| anion | аніон | анион, -ы | anio | بالاس نویا |
| bone tissue | кісткова тканина | костная ткань | tissu osseux | ي مظعلا جيسنلا |
| evaporation | випаровування | испарение, -ия | vaporisation | رخبتلا |
| hydrogen index pH | водневий показник | водородный показатель (PH) | indice pH | يني جورديها مقررلا |

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 | يُنِيدِتَبِلَا مَطْبَارِلَا |
| constructional /structural | будівельний | строительный, -ая, -ое, -ые | du bâtiment | يُنَانِبِلَا |
| enzyme | фермент, -ти | фермент, -ы (энзим, -ы) | ferment | مِيزِنَا |
| fermentative | ферментативний | ферментативный, -ая, -ое, -ые | enzymatique | يُنِيمِيزِنَلَا |
| locomotive /motive | руховий | двигательный, -ая, -ое, -ые | cinétique | يَكِرْحِي لِقَاد |
| transport | траспортний | транспортный, -ая, -ое, -ые | de transport | يَلْقَاد |
| contractile | скоротливий | сократительный, -ая, -ое, -ые | contractile | يَضَابِقِنَا |
| protective | захисний | защитный, -ая, -ое, -ые | défensif | يَعَافِد، قَاو، مَاد |
| antibody | антитіло | антитело, -а | anticorps | دَاضِم مَسْج |
| antigen | антиген | антиген, -ы | antigène | بِير غ مَسْج |
| breakdown | розщеплення | расщепление, -ия | bifidité | لِلَا حَذَلَا |
| lipids | ліпід | липид, -ы | lipide | تَادِيْبِيْلَا، تَابِيْهْدَلَا |
| lipoid | ліпоїд | липоид, -ы | lipoïde | تَابِيْمَحْش، تَابِيْهْد |
| steroid | стероїд | стероид, -ы | stéroïdes | تَادِيْوَرْتِيْسَلَا |
| cholesterol | холестерин | холестерин | cholestérol | لَوْر تَسْلُوْكَ |
| excess | надлишок | избыток | excès | دَنَاز، ضَنَاف |
| specific | специфічний | специфический, -ая, -ое, -ие | spécifique | يَعُوْد |
| cortisone | кортизон | кортизон | cortisone | نَوْرِيْتِرُوْكَ |
| gallstone | жовчні каміння | желчные камни | cholélithe | مَقْيَوَار فِصْدَة وَصْد |
| hormone | гормон | гормон, -ы | hormone | نَوْمَرَه |
| deactivate | зnezаражувати зnezаразити | обезвреживать/обезвредить | neutraliser | ثَوَلْتَا لَازَا |
| neutralize | нейтралізувати | нейтрализовать | neutraliser | لَدَاعِي |
| glycerol | гліцерин | глицерин | glycérine | نِير سِيْلَج |

Pay attention!

store [verb]

keep or accumulate (something) for future use

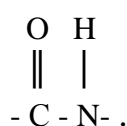
Plants store starch as granules within cellular structures called plastids.

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 $(CH_2O)_n$.

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 $(CH_2O)_n$.

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-

cleus 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 | نفاذية محدودة |
| capacity | здатність | способность, -и | faculté | قدرة |
| overleap | пропускати/пропустити | пропускать/пропустить | tréfiler | رور ملاب حمس |
| limit/restrict | обмежити | ограничивать/ограничить | restreindre | ددحيد، طيحي |
| injury | пошкодження | повреждение, -ия | altération | فسلاتا |
| regulate | регулювати | регулировать | régler | قسن، مظن، طبض |
| admission | надходження | поступление, -ия | admission | قاحتلا |
| enter | вводити/ввести | вводить/ввести | injecter | لخدأ |
| connect/join | з'єднувати/з'єднати | соединять/соединить | accoler | مضيد |
| phagocytosis | фагоцитоз | фагоцитоз | phagocytose | فوجف |
| colloidal solution | колоїдний розчин | коллоидный раствор | solution colloïdale | يور غل ولحم |
| make/commit | здійснювати/здійснити | совершать/совершить | commettre | مأ، زجنا |
| intensity | інтенсивність | интенсивность | intensité | زكرتلا |
| 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 امزلا |

| | | | | |
|-------------|----------------------|---------------------------|------------|------------------------|
| 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 | لغلغير |
| 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 الیود ذلاً مکیشلا |
| mitochondrion | мітохондрія | митохондрия | mitochondrie | ایر دنکو تیم |
| Golgi complex /apparatus | Гольджі комплекс | сетчатый аппарат (аппарат Гольджи) | appareil de Golgi, | اسجای جلوج م |
| ribosome | рибосома | рибосома | ribosome | تاموسوبیارلا |
| lysosome | лізосома | лизосома | lysosome | تاموسوزیلا |
| centrosome | центросома | центросома | corpuscule central | ریمور تنسلا |
| invaginations | інвагінації | инвагинации | intussusception | |
| rugged/rough | шорсткий | шероховатый | squarreux | نشد |
| smooth | гладкий | гладкий | glabre | م عان |
| canal/channel | канал | канал | canal | قانة |
| cavity | порожнина | полость | cavité | فوج |
| granular | гранулярний | гранулярный | granulaire | ی بید |
| accumulate | накопичувати | накапливать/накопить | accumuler | عمج، رخدا |
| kernel/grain | зерно | зерно | grain | قرزب، تبج |
| achromatin spindle | ахроматинове веретино | ахроматиновое веретено | fuseau achromatique | لکشلای تیلزغم طویخ |
| pole | полюс | полюс | pôle | بطقة |
| separation | розходження | расхождение | désunion | رابطشذلا |
| fiber | нитка | нить | fibre | طیخ، لبد |
| myofibril | міофібрила | миофибрилла | myofibrille | تیلضدع تفیلا |
| neurofibril | нейрофібрила | нейрофибрилла | neurofibrille | تیلضدع تفیلا |
| conduction | проведення | проведение | conduction | زجنا، دم، قشد |
| impulse | імпульс | импульс | impact | ضربلا |
| provide | забезпечувати/забезпечити | обеспечивать/обеспечить | accommoder | رفو، نماً، نمضد |

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.

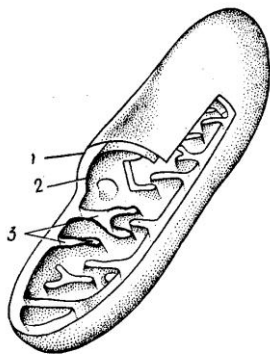
Text

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.

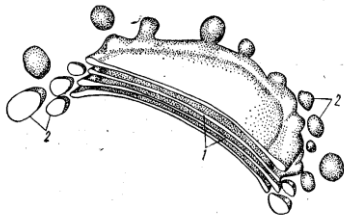
The **endoplasmic reticulum** (reticulum - network) is a special system of membranes. There are two types of endoplasmic reticulum:

- 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

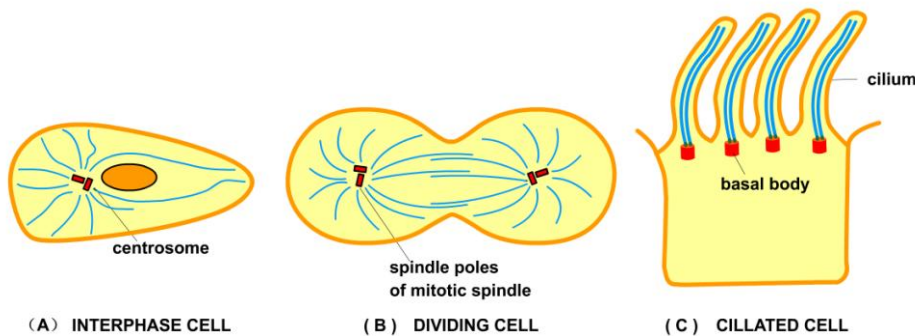
Lysosome is an organelle that contains digestive enzymes that break down proteins, polysaccharides, nucleic acids, fats, and other organic substances.

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.

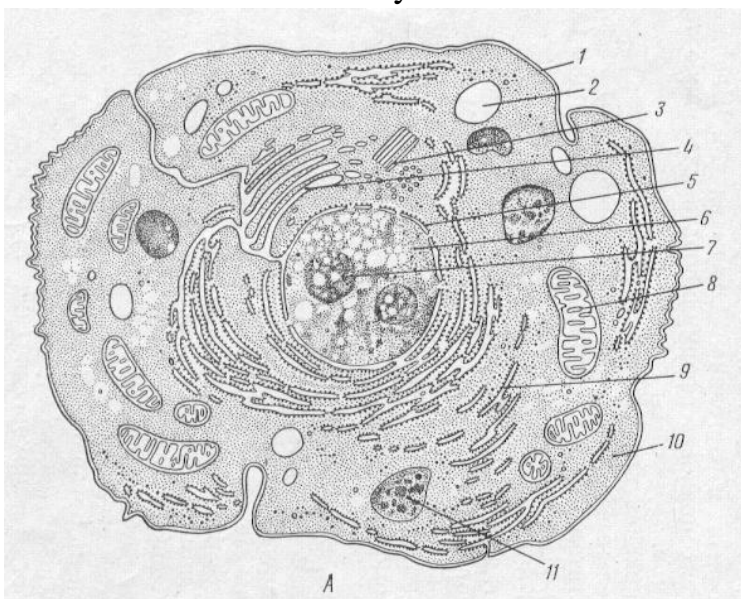
The centrosome is involved in the formation of the achromatin spindle (mitotic apparatus), which provides the movement of chromosomes to the opposite poles of the cell.



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.

Exercises 1. Answer the questions.

1. What are the different organelles that make up our cells?
2. What is the structure of mitochondria, what function do they perform?
3. What is the structure of Golgi complex, what function does it perform?
4. What is the structure of ER, what function does it perform?
5. What is the structure of ribosomes, what function do they perform?
6. What is the function of the centrosome?
7. What organelles perform only special cell functions?

Exercises 2. Fill up the table.

| Structure | Function |
|---------------|----------|
| Cell membrane | |
| Nucleus | |
| Chromosomes | |
| Nucleolus | |
| Mitochondria | |
| Ribosomes | |
| ER | |
| Golgi complex | |
| Lysosome | |

Exercises 3. Draw a cell, show its organelles in the picture.**Class 6. Laboratory work №2****"Cell structure"****Class 7. Cell division Mitosis.****Task 1.** Listen, repeat and read words and phrases:

| | | | | |
|---------------------|-----------------------|------------------------|---------------------|-----------------------|
| massed/numerous | багаточисельний | многочисленный | multiple | ددعتم |
| multiple | багаторазовий | множественный | multiple | رررررررر |
| differentiation | диференціяція | дифференциация | différenciation | تفاوت، نیا، زیامت |
| die off | відмирати | отмирать | s'atrophier | يشلات |
| disappear | зникати | исчезать | se dissiper | يقتخ |
| substitute | заміщати | замещать | remplacer | ضوء، لدبا |
| mitosis | мітоз | митоз | mitose | يزوتيملا ماسقنلا |
| meiosis | мейоз | мейоз | méiose | يزويملا ماسقنلا |
| amitosis | амітоз | амитоз | amitose | أميتوز (إنشطار مباشر) |
| continuous | безперервний | непрерывный | continu | رمتسم، لصاوت |
| set | набір | набор | paraison | مقط |
| spiralization | спіралізація | спирализация | spiralisation | أينوزلح |
| prolonged/continual | довготривалий | продолжительный | isochrone | رمتسم |
| achromatin spindle | ахроматинове веретина | ахроматиновое веретено | fuseau achromatique | لکشلا أنيلزغم طويخ |
| interphase | інтерфаза | интерфаза | interphase | ينيبلا روطلا |
| prophase | профаза | профаза | prophase | يديهمتلا روطلا |
| metaphase | метафаза | метафаза | métaphase | طيسولا روطلا |
| anaphase | анафаза | анафаза | anaphase | يلاصفنلا روطلا |
| telophase | телофаза | телофаза | télophase | ريخللا روطلا |

| | | | | |
|---------------|--------------------|----------------------|----------------------|--------------------|
| equator | екватор | экватор | équateur | ءاوتسلإا طخ |
| mitotic cycle | мітотичний цикл | митотический цикл | mitotique circuit | لزعمة قرودية |
| karyokinesis | каріюкінез | кариокінез | caryocinèse | ءاونلا ماسقنا |
| cytokinesis | цитокінез | цитокінез | cytokinèse | مزلا بوتسلا ماسقنا |

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

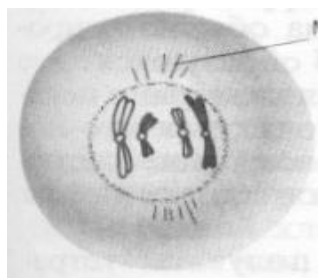
According to the cell theory, all the cells are the results of the division of pre-existing cells. A unicellular organism is divided, forming two new cells. A multicellular organism begins its development from a single cell. All its numerous cells are formed as a result of multiple cell divisions. First, 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.

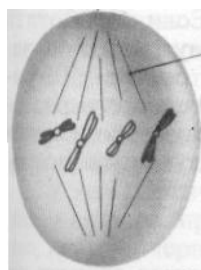
More complex cell division is mitosis. 99% of all cells divide by mitosis. In mitosis a cell divides to form two identical daughter cells. It is important that the daughter cells have copies of every parental chromosome.

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.

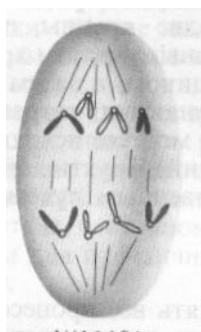
Mitosis is a continuous process that consists of four phases.



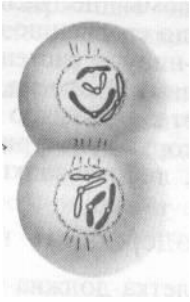
1. Prophase is the longest phase of mitosis. The nucleolus and the nuclear membrane disappear, chromosomes are spiralized, an achromatin (mitotic) spindle is formed.



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

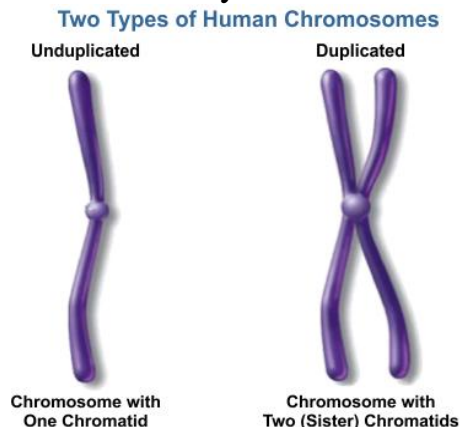


3. Anaphase is the shortest phase of mitosis. Daughter chromatids become chromosomes and diverge towards the opposite poles of the cell.



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، ضيفخة |
| decrease | зменшення | уменьшение | décroissance | لقلقة |
| increase | збільшення | увеличение | accroissement | ريبكة |
| diploid | диплоїдний | диплоидный | diploïde | ي جوز |
| haploid | гаплоїдний | гаплоидный | haploïde | ي داحا |
| 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 | رباعة، 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، لثامه |
| region | ділянка | участок | aire | عز ج، عاظة |
| 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 | بحسد، دش |
| maternal cell | материнська клітина | материнская клетка | maternel | ما قبلد |
| daughter cell | дочірня клітина | дочерняя клетка | cellule fille | قدیلو قبلد |
| cartilage | хрящ | хрящ | cartilage | فورضد |
| tendon | сухожилля | сухожилие | tendon | رتو |
| liver | печінка | печень | foie | دبك |
| 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.

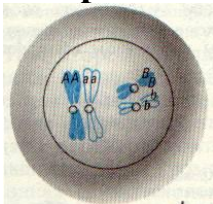
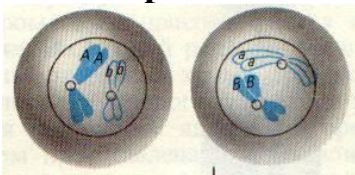
In prophase II, the nucleus contains a haploid set of chromosomes and each chromosome consists of two chromatids.

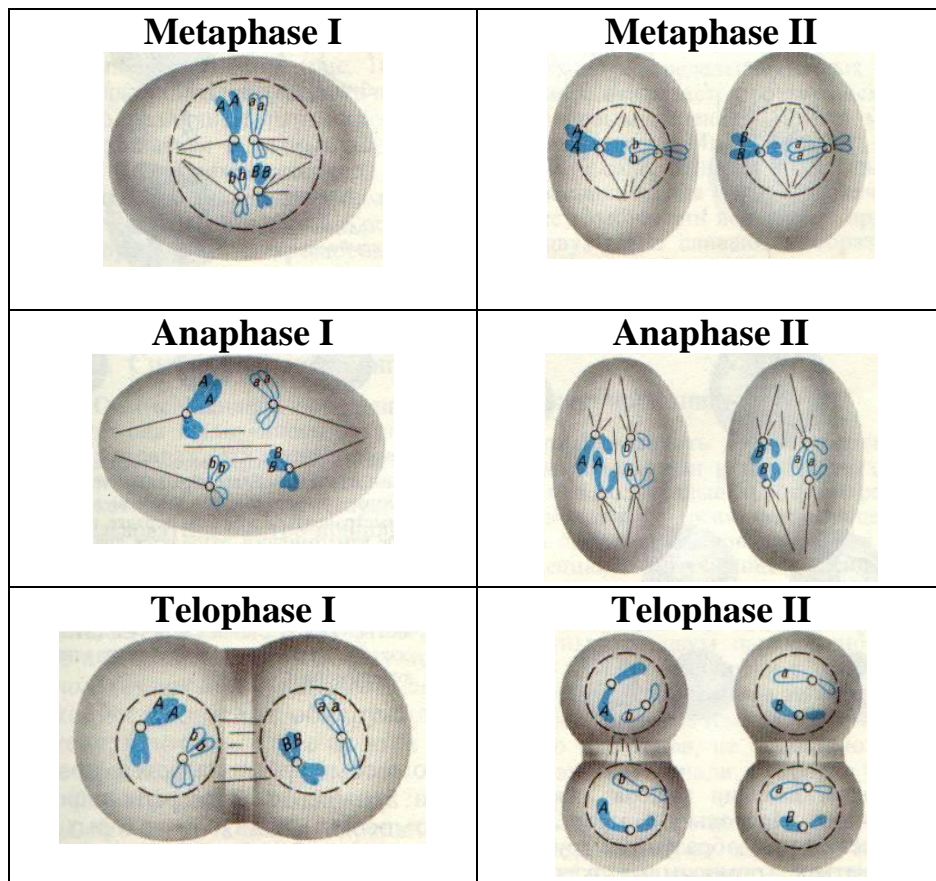
In metaphase II, chromosomes are located at the equator of the cell and the achromatin spindle is formed.

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

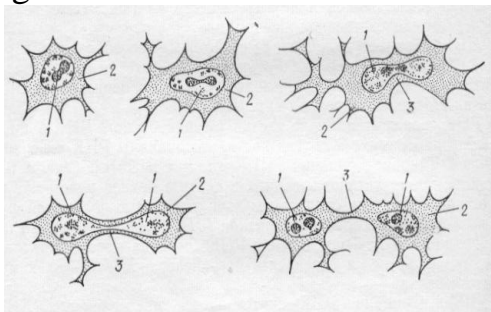
| First meiotic division | Second meiotic division |
|--------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| <p>Prophase I</p>  | <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 | сперматогенез | сперматогенез | spermatogenèse | تېونما تاناويحلا نيوكتا تيلم |
| oogenesis | оогенез | оогенез | oogenèse | تندلا تضيوبلا نيوكتا تيلمعتيو |
| spermatogonia | сперматогонії | сперматогонии | cellule spermatique | تېونم تيلخ |
| oocyte | ооцит | ооцит | ovocyte | تېونندلا تضيوبلا تيلخ |
| polar body | полярні тільця | полярные тельца | corpuscule polaire | ي بطقة ميسج |
| subsequent/following | наступний | последующий | subséquent | تأ، ق دلا |
| reach | досягати/досягнути | достигать/достигнуть | atteindre | ي لعلأ دحلا غلب |
| embryo | зародок | зародыш | embryon | ن ينج |

Pay attention!

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

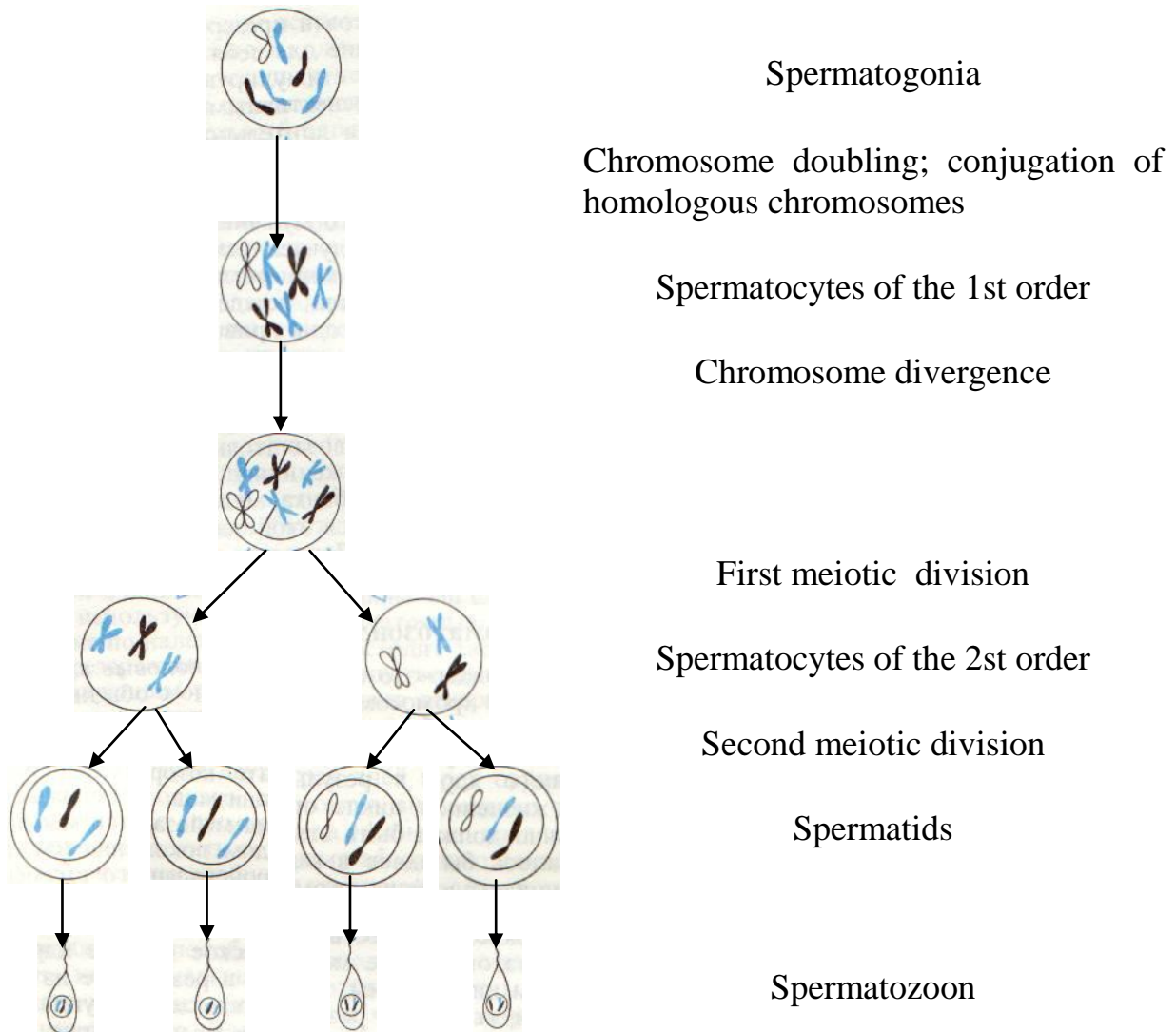
Fertilization occurs when the nucleus of both a sperm and an egg fuse to form a diploid cell, known as zygote.

Task 2. Listen and read text.

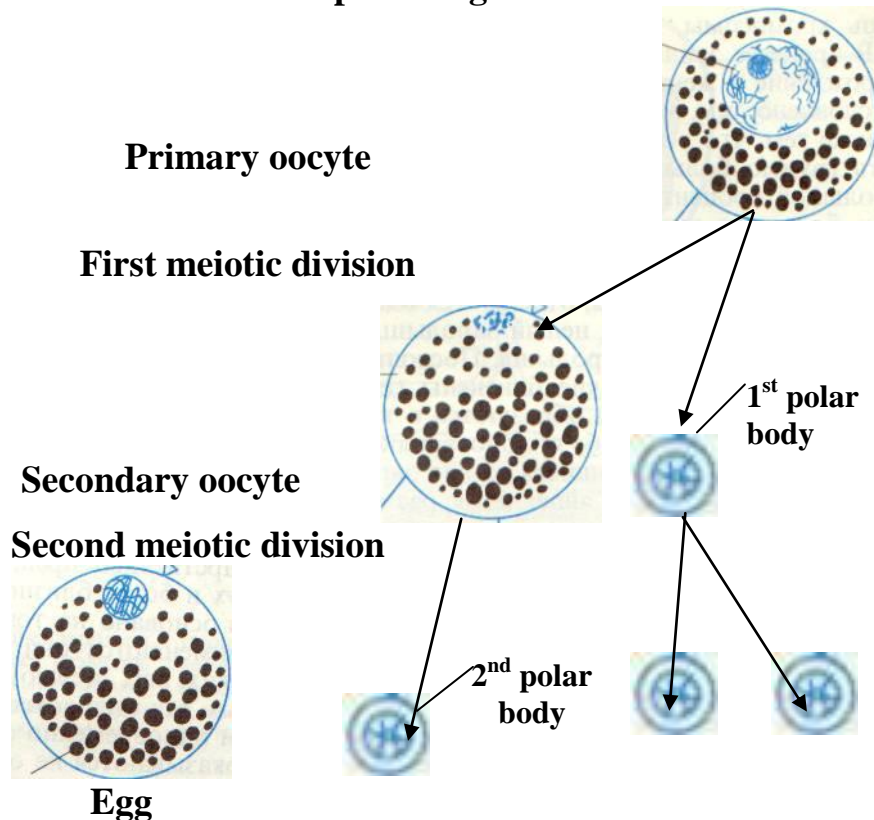
Eggs and spermatozoa are gametes containing half (haploid, n) set of chromosomes compared to somatic cells. When the egg cell is fused with the sperm cell in the fertilized egg, the normal (diploid, $2n$) set of chromosomes is restored.

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 | تجسلاء |
| complex | комплекс | комплекс | complexe | دفعه |
| similar/analogous | подібний | сходный | homologue | میشد، لثام |
| definite | певний/визначений | определенный | déterminé | نعمه، ددحم |
| integumentary | покривний | покровный | tégumentaire | غطاء (ما يغطي الجسم) |
| sense organs | органи чуття | органы чувств | les organes des sens | سحلا ءاضعا |
| epithelial tissue | епітеліальна тканина | эпителиальная ткань | tissu épithélial | ي نلاط جيسند |
| connective tissue | сполучна тканина | соединительная ткань | tissu conjonctif | ماضد جيسند |
| muscular tissue | м'язова тканина | мышечная ткань | tissu musculaire | ي لضع جيسند |
| nervous tissue | нервова тканина | нервная ткань | tissu nerveux | ي بصء جيسند |

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.

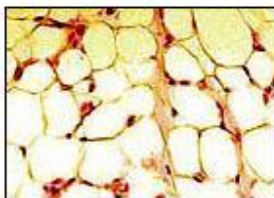
Text

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

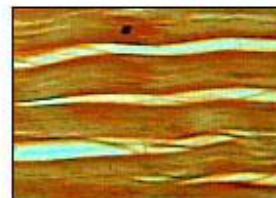
Complexes of cells and intercellular substance, similar in structure, function and origin, form certain types of tissue.



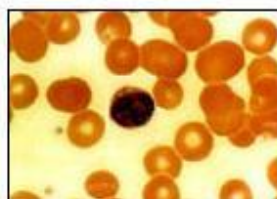
Areolar connective tissue



Adipose tissue



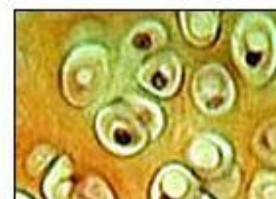
Fibrous connective tissue



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 | نطب |
| flat epithelium | плоский епітелій | плоский эпителий | épithélium squameux | قرايط جيسند (تيجسطد و سكي احطس) |
| cuboidal epithelium | кубічний епітелій | кубический эпителий | épithélium cubique | بعكم جيسند |
| single-layered epithelium | одношаровий епітелій | однослойный эпителий | épithélium monostratifié | ي داحا جيسند |
| multilayered/stratified epithelium | багатошаровий епітелій | многослойный эпителий | épithélium polystratifié | ي قبط جيسند |
| cylindrical epithelium | циліндрічний епітелій | цилиндрический эпителий | épithélium cylindrique | ي ناوطسا جيسند |
| ciliated epithelium | миготливий епітелій | мерцательный эпителий | épithélium cilié, | بدهم جيسند |
| mucous membrane | слизова оболонка | слизистая оболочка | membrane muqueuse | ي طاخم عاشد |
| serosa | серозна оболонка | серозная оболочка | membrane séreuse | ي لصم عاشد |
| gland/glands | залоза, -и | железа, -ы | glande | قد |
| adjoin each other | прилягають один до одного | прилегают друг к другу | adhérent | محازت، ضعب مضعب ق صتل |
| layer | шар | слой | couche | تقبط |
| absorption | всмоктування | всасывание | absorption | ص اصتما |
| discharge/excretion | виділення | выделение | émission | زرفم |
| drying | висихання | высыхание | dessiccation | فجفت |
| secretion/secretum | секрет | секрет | sécréta | زارفا |
| kidney | нирка | почка | rein | تيلك |
| corneous | роговий | роговой | couche cornée | تيزرق |
| skin | шкіра | кожа | cutis | دلج |
| cover | вкривати | покрывать | abriter | ي اط، ي طغ |

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.

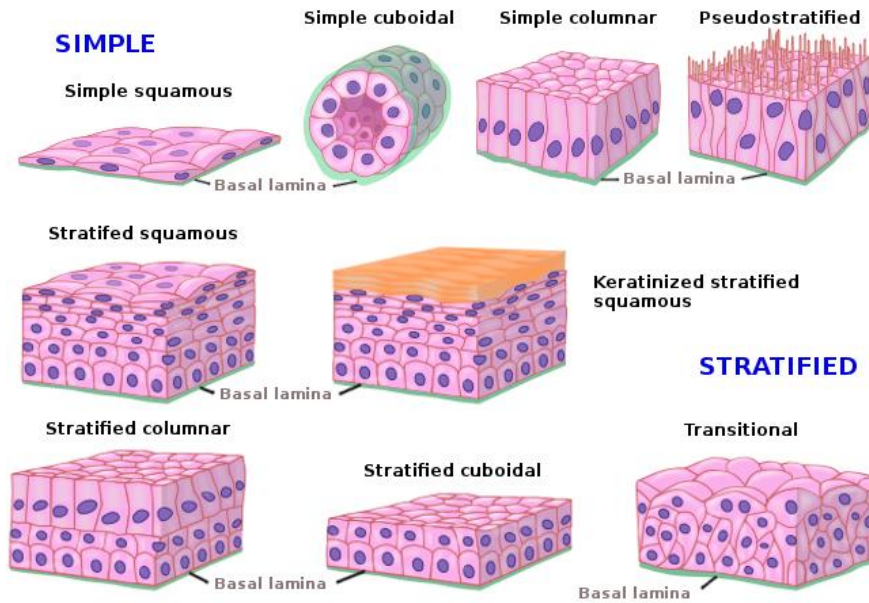
Epithelial tissues line the outer surfaces of organs and blood vessels throughout the body, as well as the inner surfaces of cavities in many internal organs. An example is the epidermis, the outermost layer of the skin. Through the epithelium, there is a metabolism between the body and the environment. 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 ينقبط نيب |
| reticular tissue | тканина сполучна ретикулярна | ткань соединительная ретикулярная | tissu réticulé | ماض ي كيش چيسن |
| spongy tissues | тканина сполучна пухка | ткань соединительная рыхлая | tissu cribriforme | ماض يوخر چيسن |
| fibrous tissue | тканина сполучна волокниста | ткань соединительная волокнистая | un tissu fibreux | ماض ي فيلا چيسن |
| cartilaginous tissue | тканина хрящова | ткань хрящевая | tissu cartilagineux | ي فورضغ چيسن |
| bone [osseous] tissue | тканина кісткова | ткань костная | tissu osseux | ي مظع چيسن |
| spindle cell | клітина веретено-подібна | клетка веретенообразная | cellule fusiforme | تيلز غم تيلخ |
| stellate cell | клітина зірчаста | клетка звездчатая | cellule stellaire | تيمجد تيلخ |
| elastic fibers | волокна еластичні | волокна эластические | fibre élastique | تترم فايلا |
| reticular fiber | волокна ретикулярні | волокна ретикулярные | fibre de réticuline | تیکبش فايلا |
| tendon | сухожилля | сухожилие | tendon | رتو |
| spine/vertebra | хребет | позвоночник | colonne vertébrale | يرقف دومع |
| vertebra | хребець(хребці) | позвонок(позвонки) | vertèbre | يرقفلا دومعلا نم قرقف |
| 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:

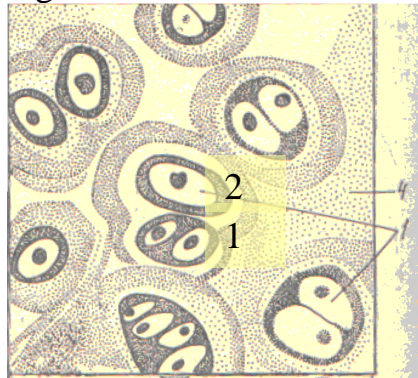
- **connective tissues** (reticular tissue, spongy tissue, dense fibrous tissue, adipose tissue);
- **supporting tissues** (cartilaginous tissue, bone tissue);
- **blood and lymph.**

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.

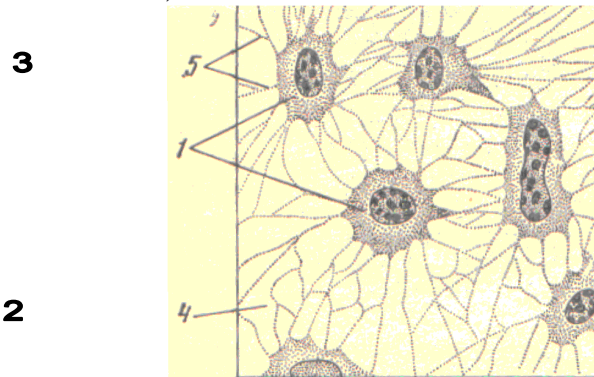
Spongy tissue consists of stellate and spindle-shaped (elongated) cells (about 10 different species), collagen and elastic fibers. It forms interlayers between organs.



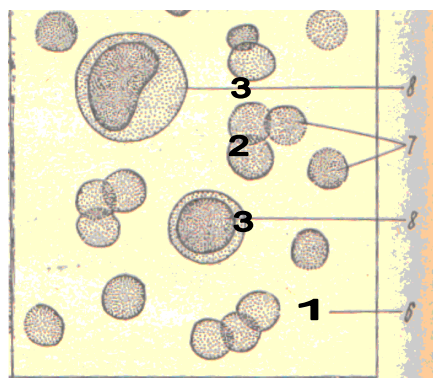
Spongy tissue: 1-cells; 2-collagen fibers; 3-elastic fibers; 4- intercellular substance.



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 | امزلا بلا |
| blood serum | сироватка крові | сыворотка крови | sérum sanguin | مدلا لصم |
| leukocyte | лейкоцит | лейкоцит | leucocyte | عاضیلا مدلا تایرک |
| platelet/ thrombocyte | тромбоцит | тромбоцит | thrombocyte | تیومد تحیفص |
| erythrocyte | еритроцит | эритроцит | érythrocyte | عارمحا مدلا تایرک |
| 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 | تیفمیللا قیلخ |

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 | ضيقاً |
| contract/shrink | скорочуватися | сокращаться | contractibilité | ضيقاً |
| provide | забезпечити | обеспечивать | accommoder | رفقاً، منماً، منمداً |
| locomotion/movement | пересування | передвижение | locomotion | أثر حركته |
| contractile | скоротливий | сократительный | contractilité | ضيقاً |
| myofibril | міофібрилла | миофибрилла | myofibrille | ألياف عضلية |
| smooth muscular tissue | гладка м'язова тканина | гладкая мышечная ткань | tissu musculaire lisse | سليماً، ليماً، ليماً |
| transversal striated muscle tissue | поперечносмугаста сердцева м'язова тканина | поперечнополосатая сердечная мышечная ткань | tissu musculaire striée | ليفويجي، ليفويجي، ليفويجي |
| transversal skeletal muscle tissue | поперечносмугаста скелетна м'язова тканина | поперечнополосатая скелетная мышечная ткань | tissu musculaire striée | ليفويجي، ليفويجي، ليفويجي |
| sarcolemma | сарколема | сарколемма | sarcolemme | ليفويجي، ليفويجي، ليفويجي |
| strip | смуга | полоса | strie | ألياف، ليفويجي، ليفويجي |
| tongue | язик | язык | langage | لغة |
| pharynx | глотка | глотка | pharynx | معدية |
| heart | серце | сердце | cœur | قلب |
| musculature | м'язи/мускулатура | мускулатура | musculature | ليفويجي، ليفويجي، ليفويجي |

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.

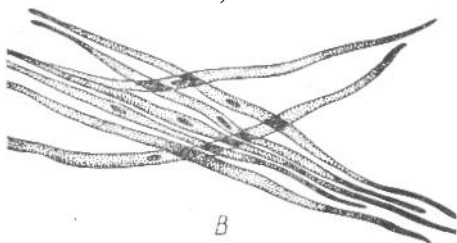
Text

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.

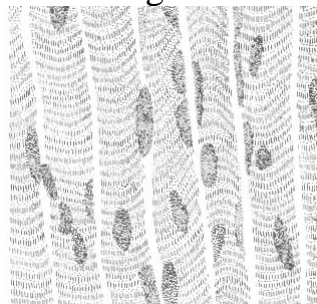
In the cytoplasm of muscle cells there are special contractile threads - **myofibrils**.

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 | нейроглия | tissu glial | خمسلا ايلاذنم عود |
| dendrite | дендрит | дендрит | dendrite | زائدة شجرية (في الخلية العصبية) |
| axon | аксон | аксон | axone | نبيصعلا نغيللا 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 | نبيطقتاذ نبيصع |
| multipolar neuron | мультиполярний нейрон | мультиполярный нейрон | neurone multipolaire | باطقلا تددعتم نبيصع |
| branch out | галузитися | 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)

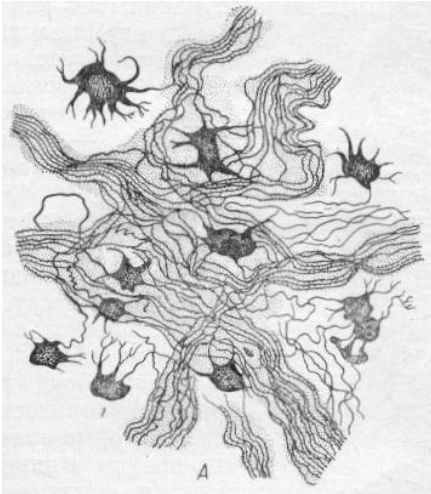
to bring or come together in a large number or amount in one particular area

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**.

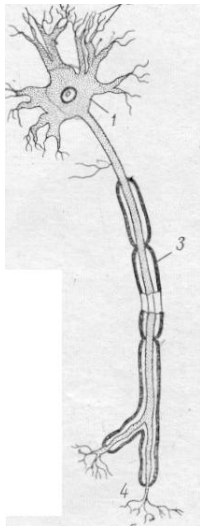
Unipolar neurons are found in spinal nerve cell bodies and cranial nerves. Bipolar neurons are sensory neurons consisting of one axon and one dendrite that extend from the cell body.

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:

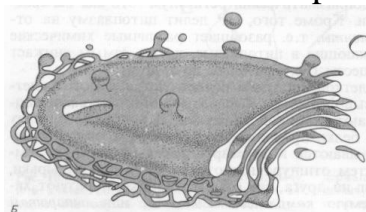
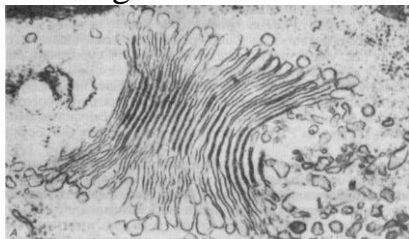
neuron, neuritis, neuroglia, dendrite, axon, excitability, conductivity.

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) | дезоксирибонуклеїнова кислота | дезоксирибонуклеиновая кислота (ДНК) | acide désoxyribonucléique | حمض نووي رايبوزي منقوص الأكسجين DNA |
| ribonucleic acid (RNA) | рибонуклеїнова кислота | рибонуклеиновая кислота | acide ribonucléique | يزوبيارلا ييونا ضامحاً |
| mitochondrion (plural is mitochondria) | мітохондрія | митохондрия | acide ribonucléique | اير دنكوتيم |
| endoplasmic reticulum | ендоплазматичний ретикулум/сітка | эндоплазматический ретикулум/сеть | réticulum endoplasmique | نيملابودنلا تكميشلا |
| achromatin spindle | ахроматинове веретини | ахроматиновое веретено | fuseau achromatique | خيوط مغزلية (تكون عند انقسام الخلايا) |
| sarcolemma | сарколема | сарколемма | sarcoleme | ي اضع رادج |
| myofibril | міофібрила | миофибрилла | myofibrille | نيلضع تكميل |
| transversal striated muscle tissue | поперечносмугаста м'язова тканина | поперечнополосатая мышечная ткань | tissu musculaire strie | ي فيوجت ي اضع جيسند |
| unipolar neuron | уніполярний нейрон | униполярный нейрон | neurone unipolaire | ببطقلا تيداحاً نيلضع |
| bipolar neuron | біполярний нейрон | биполярный нейрон | neurone bipolaire | ن ببطقلا تاذ نيلضع |
| multipolar neuron | мультиполярний нейрон | мультиполярный нейрон | neurone multipolaire | باطقلا تاددعتم نيلضع |
| dendrite | дендрит | дендрит | dendrite | زائدة شجرية (في الخلية العصبية) |
| axon | аксон | аксон | axone | نيلضعلا تقيلا روحم |
| neurite | нейрит | нейрит | neurite | بصلعار روحم |
| neuroglia | нейроглія | нейроглия | tissu glial | نملا ابلاخن م عوند |
| excitability | збудливість | возбудимость | excitabilité | جيته، 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.