

Ministry of Health of Belarus Republic
Vitebsk State Medical University
Department of Medical Biology and General Genetics

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PRACTICAL BOOK ON BIOLOGY
for foreign citizens of preparatory division

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В практикуме рассматриваются: сущность жизни, уровни организации живого, биология и физиология клетки, размножение организмов, индивидуальное развитие, наследственность и изменчивость, вирусы, бактерии, водоросли, лишайники, грибы, растения, животные, особенности строения и физиологии человека.

Практикум включает 34 темы практических и 5 – итоговых занятий. Каждое практическое занятие состоит из вводной части материала, цели занятия, вопросов, основных понятий и терминов для подготовки к занятию, 20 тестов для проверки уровня знаний по теме, литературы для подготовки и материалов для выполнения практической работы. Итоговые занятия включают цель, вопросы для подготовки, литературу и материалы для выполнения практической работы.

Для иностранных граждан, поступающих в медицинские университеты, слушателей подготовительного отделения, студентов первого курса, обучающихся на русском и английском языках.

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CONTENTS

Theme №1.	Biology is the science of the main regularities of the phenomena of life. Cell theory.....	5
Theme №2.	Chemical composition of cell. Inorganic substances. Organic substances: carbohydrates, lipids.....	8
Theme №3.	Chemical composition of cell. Organic substances: proteins, nucleic acids.....	11
Theme №4.	Cell morphology. Wall. The cytoplasm, its structural components.....	14
Theme №5.	Cell morphology. Structure and functions of the nucleus...	18
Theme №6.	Metabolism and energy exchange.....	21
Theme №7.	Life cycle of cells.....	26
Theme №8.	Reproduction of organisms.....	31
Theme №9.	Individual development of organisms.....	35
Theme №10.	Bases of cytology, reproduction and individual development (summing-up class).....	39
Theme №11.	Genetics as a science of heredity and variation. Patterns of inheritance of traits.....	41
Theme №12.	Genetics of sex. Linked inheritance.....	46
Theme №13.	Phenotypic and genotypic diversity.....	50
Theme №14.	Fundamentals of genetics (summing-up class).....	54
Theme №15.	Systematics of the organic world. Viruses. Bacteria.Fungi.....	56
Theme №16.	Botany isa science about plants. Algae. Lichens.....	59
Theme №17.	Higher plants. Vegetative and generative organs of plants.	61
Theme №18.	Higher plants. Mossy. Fern.....	64
Theme №19.	Higher plants. Gymnosperms. Angiosperms.....	66
Theme №20.	Viruses. Bacteria. Fungi. Plants (summing-up class).....	69
Theme №21.	Zoology is a science about animals. Monocellular animals	71
Theme №22.	Type Coelenterates. Type Flatworms.....	74

Theme №23.	Type Roundworms.....	77
Theme №24.	Type Annelids. Type Mollusks.....	79
Theme №25.	Type Arthropods.....	82
Theme №26.	Type Chordates. Class Amphioxus.....	85
Theme №27.	Subclass Fish. Class Amphibians.....	88
Theme №28.	Class Reptiles. Class Aves. Class Mammals.....	91
Theme №29.	Animals (summing-up class).....	94
Theme №30.	Human. Main types of tissues.....	95
Theme №31.	Musculoskeletal system.....	98
Theme №32.	Digestive system.....	101
Theme №33.	Respiratory system.....	103
Theme №34.	Excretory system. Skin.....	106
Theme №35.	Circulatory system.....	109
Theme №36.	Nervous system.....	112
Theme №37.	Endocrine glands.....	114
Theme №38.	Reproduction of human.....	117
Theme №39.	Human (summing-up class).....	120
	Keys to the tests.....	122

Theme №1.

Biology is a science of main regularities of the phenomena of life. Cell theory.

Biology is the science of life, which studies life as a special form of matter being, the laws of its existence and development. The fundamental properties of living things include: metabolism, energy and information, homeostasis, reproduction, growth and development, irritability and movement, heredity and variation, resolution and integrity, structural organization. Evolutionary-conditioned levels of life organization are molecular-genetic, cellular, ontogenetic, population-species and the biospherical-biogeocenotic.

The objective: 1. To study the basic properties of living things, levels of organization of living systems, stages of development of the cell theory. 2. To specify the structure of elementary structure and elementary phenomenon of every level of the organization of living things, to formulate the position of classical and modern cell theory. 3. Introduction to the Department of Medical Biology and General Genetics, methods of teaching at the department.

Get ready to speak about:

1. Biology is the science of nature.
2. Evolutionary caused levels of the organization living matter.
3. Properties of living things.
4. Acellular and cellular life forms. The concept of prokaryotes and eukaryotes.
5. Cytology is the science of the cell.
6. The cell theory, the main stages of its development. The current state of the cell theory.

Basic concepts and terms

Biology – a science of life, which studies life as a special form of matter being, the laws of its existence and development.

Homeostasis – the properties of living organisms to maintain a relatively constant composition and the dynamic properties of the internal environment.

The metabolism – the set of chemical reactions in living organisms that support them.

Reproduction – the ability of organisms to reproduce themselves.

Viruses are acellular life forms consisting of nucleic acid (DNA or RNA) and protein shell (capsid).

Prokaryotes are cellular life forms that do not have a nucleus.

Eukaryotes are organisms whose cells have a nucleus.

Cytology is the science that studies the structure, chemical composition, function and development of a cell.

Check tests

1. Biology is: a) the science of life, which studies life as a special form of matter being, the laws of its existence and development.; b) the science of the cell; c) the science of tissue.

2. The subject of biological studies: a) living organisms; b) natural communities; c) cells of unicellular and multicellular organisms; d) cellular metabolism.

3. The elementary structure of the molecular-genetic level: a) cell; b) codes of genetic information; c) tissues and organs; d) population.

4. The elementary phenomenon of molecular genetic level a) cell division; b) reproduction of the code of genetic information; c) protein synthesis; d) change biogeocenosis.

5. The elementary structure of the cellular level: a) cell; b) tissue; c) the body; d) population.

6. The elementary phenomenon of the cellular level: a) life cycle of cells; b) DNA replication; c) change of biogeocenosis; d) ontogeny.

7. The basic structure of the ontogenetic level: a) tissue; b) the organ; c) organism; d) biosphere.

8. Elementary phenomenon of ontogenetic level: a) the differentiation of tissues; b) the division of cells; c) individual development of the organism; d) change of biogeocenosis.

9. The basic structure of the population-species level: a) population; b) the cell; c) the organism; d) tissues and organs.

10. The elementary phenomenon of population-species level: a) changes in the gene pool of a population; b) change of biogeocenosis; c) cell division; d) reproduction of organisms.

11. The basic structure of the biospherical-biogeocenotic level: a) population; b) biogeocoenosis; c) species; d) organism.

12. The elementary phenomenon of the biospherical-biogeocenotic level: a) formation of species; b) the transition of biogeocenosis from one unstable state to another; c) DNA replication; d) reproduction of organisms.

13. Properties of living things: a) the discretion and integrity, structural organization; b) growth and development, irritability and movement, heredity and variation; c) the reproduction, homeostasis; d) the exchange of matter and energy.

14. Non-cellular life forms includes: a) fungi; b) viruses; b) bacteria; d) plants.

15. Prokaryotes include: a) fungi; b) the blue-green algae; b) bacteria; d) plants.

16. Eukaryotes include: a) viruses; b) fungi; c) plants; d) bacteria; e) animals.

17. Cytology is: a) the science that studies animals; b) the science that studies plants; c) the science that studies the cells of unicellular and multicellular organisms; d) the science that studies heredity and variation.

18. R. Hooke discovered: a) viruses; b) nucleus; c) mitochondria; d) the cell.

19. R. Brown discovered: a) bacteria; b) nucleus; c) mitochondria; d) the cell.

20. Who has formulated the classic cell theory: a) R. Hooke; b) J. Purkinje; c) R. Brown; d) T. Schwann.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreign learners of preparatory division. – Vitebsk VSMU, 2016. – P. 4–6.

Practical activities

I. Fill in the table:

"Levels of organization of living things"

Level of organization of the livingthings	The elementary units	The elementary phenomenon
Molecular genetic level		
Cellular level		
Ontogenetic level		
Population-species level		
Biosphere-level		

Theme №2.

Chemical composition of the cell. Inorganic substances. Organic substances: carbohydrates, lipids.

The chemical composition of cells in plants and animals is very similar. In the cells of living organisms about 90 elements of the periodic system of D.I. Mendeleev are found. Depending on their content percentage and significance chemical elements are divided into three groups: macronutrients (oxygen, carbon, hydrogen, nitrogen components in the amount of 98% of the cell content), minerals (magnesium, sodium, iron, potassium, calcium, sulfur, phosphorus, chlorine; they account for 1.9%) and ultramicroelements (copper, zinc, boron, manganese, fluoride, and other - less than 0.1%). All chemical elements are included in the cells of organic and inorganic substances. Inorganic substances are presented in a cell by water and mineral salts. Organic substances include proteins, carbohydrates, fats, nucleic acids, ATP.

The objective: 1. To study the chemical content of cells, the biological significance of inorganic and organic substances (carbohydrates and lipids) that are part of the cell. 2. To classify chemicals according to their content in the cell. 3. To consider the variety of organic and inorganic substances in the cell.

Get ready to speak about:

1. The content of chemical elements in the cell, their classification.
2. Inorganic and organic substances of the cell.
3. The water content and its role in the life of the cell.
4. Mineral salts, their significance for the organism.
5. Carbohydrates. Mono-, di- and polysugars. The biological role of carbohydrates.
6. Fats, their biological role.

Basic concepts and terms

Macronutrients – basic chemical elements that make up the organic and inorganic content, without which the growth and development of the organism is not possible. Their share is 98%.

Micronutrients – chemical elements that make up the hormones, vitamins, enzymes and other compounds, their share is 1.9%.

Ultramicronutrients – chemical elements that make up the organic and inorganic compounds, the content of which in the cell does not exceed 0.1%.

Carbohydrates - organic compounds composed of carbon, hydrogen and oxygen.

Lipids - esters of glycerol and higher fatty acids.

Check tests

1. Macronutrients include elements: a) Fe, Cu, Cl; b) Ni, P, J; c) O, N, H, C; d) Au, Zn, Mg.

2. Micronutrients include elements:a) Fe, Ca, Cl, Mg; b) O, H, C, N; a) Zn, Cu, Co, Mn.

3. Ultramicronutrients include: a) O, H, C, N; b) Fe, Ca, Cl, Mg; c) Zn, Cu, Co, Mn.

4. Phosphorus is a part of: a) nucleic acids; b) water; c) carbohydrate; d) ATP.

5. Magnesium is a part of: a) carbohydrate; b) chlorophyll; c) the thyroid hormone; d) fat.

6. Zinc is a part of:a) pancreas hormone; b) hemoglobin; c) chlorophyll; d) thyroid hormones.

7. The strength of bone structure is provided by salts: a) potassium; b) carbonates; c) calcium; d) phosphates.

8. The process of blood clotting involves ions: a) Na; b) K; c) Ca; d) Fe.

9. Inorganic substances of cells include: a) proteins; b) water; b) lipids; d) mineral salts.

10. Organic substances of cells include:a) ATP; b) carbohydrates; c) lipids; d) a protein; e) DNA, RNA.

11. The role of water in the cell:a) transport; b) a dissolvent and a chemical reagent; c) a source of oxygen during photosynthesis; d) temperature stabilizer and thermoregulator.

12. The hydrophilic substance of the cell: a) fats; b) mono and disugars; c) mineral salts; d) an alkali.

13. Hydrophobic substances of the cells:a) fats; b) monosugars; c) inorganic salts; d) polysugars.

14. Monosugars include: a) lactose; b) cellulose; c) glucose; d) fructose.

15. Disugars include: a) fructose and galactose; b) sucrose and lactose; c) maltose and sucrose; d) cellulose and starch.

16. Polysugars are: a) the nucleic acid; b) cellulose; c) starches; d) glucose.

17. Monomers of polysugars: a) glycerol; b) a carboxylic acid; c) glucose; d) sucrose.

18. The functions of carbohydrates: a) construction; b) energy; c) information; d) enzyme.

19. Fats include:a) lipids; b) waxes, and steroids; c) glycogen; d) amino acids.

20. Functions of lipids:a) energy; b) enzyme; c) a structural; d) a source of metabolic water; e) regulatory.

21. The complex of higher carboxylic acids and alcohols are: a) carbohydrates; b) proteins; c) fats; d) nucleic acid.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreign learners of preparatory division. – Vitebsk VSMU, 2016. – P. 16–20.

Practical activities

I. Fill in the table:

"Chemical composition of cells"

Compound	Biological value
Chemical elements: C, H, N, O Fe Zn Ca P K Na I	
Water	
Carbohydrates	
Lipids	

Theme №3.

Chemical content of the cell. Organic substances: proteins, nucleic acids.

Organic substances are presented in a cell by proteins, carbohydrates, lipids, nucleic acids and ATP. Proteins are polymer compounds composed of

amino acids. Depending on the spatial configuration of proteins can have a primary (amino acid sequence), secondary (helical configuration), tertiary (globule) and quaternary (association of several protein molecules) structure.

Nucleic acids were first detected in the nuclei of cells by F. Miescher. Monomer nucleic acids are nucleic acids consisting of a nitrogenous base, a carbohydrate and a phosphoric acid residue. Nucleotide devoid of phosphoric acid residue is called a nucleoside.

E. Chargaff conducted a quantitative analysis of DNA and formulated the following rules:

1. The amount of adenine equals the amount of thymine ($A = T$).
2. The amount of guanine equals the amount of cytosine ($G = C$).
3. The amount of purine equals the amount of pyrimidine ($A + T = G + C$).
4. The amount of the base with 6-amino group is equal to the amount of bases with 6-keto group ($A + C = T + G$).
5. The ratio of the bases $A + T / G + C$ is the amount strictly species-specific.

The objective: 1. To study the features of the structure and biological importance of organic substances belonging to the cell (proteins, nucleic acids, ATP). 2. To solve the case studies on DNA replication. 3. Read the rules, E. Chargaff, postulates D. Watson and Francis Crick.

Get ready to speak about:

1. Proteins, particularly their structure. The role of proteins in the cell.
2. Nucleic acids, their types.
3. The structure of the DNA molecule. Localization of DNA in the cell. DNA replication.
4. The structure of RNA. RNA kinds, their characteristics.
5. ATP, especially its structure. The biological role in the cell.

Basic concepts and terms

Proteins – high molecular weight organic compounds consisting of amino acid residues.

Denaturation – changes of the protein structure under the influence of chemical and physical factors.

Nucleic acids – high molecular weight organic compounds that store and transmit genetic information.

Nucleotide – a monomer of nucleic acids consisting of a nitrogenous base, pentahydric sugar and phosphoric acid residue.

Replication – the process of DNA duplication.

ATP – mononucleotide comprising adenine, ribose and three residues of phosphoric acid. It is the main source of energy in the cell.

Check tests

1. The monomer of protein is: a) water; b) carbohydrate; c) amino acid; d) nucleotide.

2. Connection provides primary structure of a protein:a) peptide; b) hydrogen; c) disulfide; g) ion.

3. Connection provides secondary structure of a protein: a) ion; b) peptide; c) hydrogen; d) disulfide.

4. Links that ensure the formation of the tertiary structure of a protein: a) ion; b) peptide; c) hydrogen; d) disulfide.

5. What structure is characterized by the formation of protein globules: a) primary; b) secondary; c) tertiary; d) quaternary.

6. Denaturation is: a) restoration of the structure of the protein; b) violation of the structure of the protein under the influence of chemical and physical factors; c) the process of protein synthesis.

7. The functions of proteins in the cell:a) enzymatic and regulatory; b) structural and energy; c) transport and contractile; d) protection.

8. Localization of DNA in the cell:a) nucleus; b) hyaloplasm; c) mitochondria; d) chloroplasts.

9. Monomers of nucleic acid are: a) nitrogenous base; b) ribose; c) nucleotides; d) amino acids.

10. The nucleotide composition comprises: a) glycerol; b) nitrogenous base; c) carbohydrate; d) phosphoric acid residue.

11. The nitrogen bases that make up DNA:a) adenine; b) cytosine; c) guanine; d) uracil; e) thymine.

12. Carbohydrate, which is a part of DNA: a) glycogen; b) deoxyribose; c) ribose; d) lactose.

13. The number of polynucleotide chains of DNA: a) one; b) two; c) three; d) four.

14. Links between the polynucleotide chains of DNA: a) ion; b) peptide; c) hydrogen; d) disulfide.

15. The functions of DNA: a) protection; b) custodian of the genetic information in a cell; c) transport of amino acids; d) structural.

16. The nitrogen bases that make up RNA:a) adenine; b) cytosine; c) guanine; d) uracil; e) thymine.

17. Carbohydrate, which is a part of RNA: a) glycogen; b) deoxyribose; c) ribose; d) lactose.

18. The number of polynucleotide chains of RNA:a) one; b) two; c) three; d) four.

19. Functions of m-RNA: a) transport of amino acids; b) transfer of genetic information from the nucleus to the ribosomes in the cytoplasm; c) structural; d) protection.

20. Functions of t-RNA:a)transport of amino acids; b) storage of genetic information; c) block; d) protection.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreign learners of preparatory division. – Vitebsk VSMU, 2016. – P. 20–23.

Practical activities

I. Fill in the tables:

«Chemical composition of cells»

Compound	Biological value
Proteins	
DNA	
iRNA	
tRNA	
rRNA	
ATP	

«Comparative characteristics of DNA and RNA»

Nucleic acid	Nitrogenous base	Carbohydrate	Number of polynucleotide chains	Localization in cell
DNA				
RNA				

II. To solve the problem on DNA replication:

№1. One DNA strand has the following sequence of nucleotides ATGCTAATGTCTCTTTCTTCAA. Determine the nucleotide sequence of the second strand.

№2. Define the sequence of nucleotides in a DNA chain, which is formed by the replication of the gene, having the following structure: ATTCATCGATTCTCTTTTCGAGGAGT.

№3. A fragment of one of the strands of DNA has the following nucleotide sequence AAAGATTCATCATATTTTCTGTTACTA. Write the structure of a complementary DNA strand formed during replication.

№4. Portion of one strand of DNA consists of a sequence of codes: AGGGAATATATCTCATATCGAGTAATTCTT. Determine which codes will be a part of the second DNA strand, and the order in which they are located.

№5. The resulting portion of the DNA molecule is the following triplets: GTCGATCATTATTCGTCGTAGTAGAATT. To determine contiguous nucleotides in a DNA strand serving as a template for synthesis of the site.

№6. The zone includes the following DNA nucleotides: AATCAAATCTTATCTCTTAGTTAGAGTGATCATCTT. Write the second strand of the nucleotide sequence of the DNA molecule.

№7. One part of the DNA molecule has the following nucleotide sequence: AGGTCATTCATACTCTCGA. What will be the structure of the second strand of the DNA molecule?

Theme №4.

Cell morphology. Wall. The cytoplasm, its structural components.

The structural components of eukaryotic cells are the cell membrane, cytoplasm and nucleus. Represented by the outer cell wall of the cytoplasmic membrane, cell wall (plants) and the glycocalyx (some animals). The cytoplasm includes hyaloplasm, organelles and inclusions.

The biological membrane has liquid-mosaic structure (Singer model). It consists of three layers. Protein layers are arranged between the lipid layers. Each lipid molecule has hydrophilic and hydrophobic groups. Lipids form two layers, with their hydrophobic ends facing each other. The protein layers are not continuous. Part of the protein molecules located on the surface of a portion immersed in the lipid layer of the protein permeates the lipid layer through forming hydrophilic pores. The membranes of organelles have the same

principle of the structure, but may differ quantitative ratio of protein and lipid, and their location in the membrane structure.

Organelles are highly differentiated cytoplasmic permanent formations that perform certain functions. There are organelles of general and special purpose. General purpose organelles (mitochondria, Golgi complex, endoplasmic reticulum, ribosomes, lysosomes, the cell center, plastids) are found in all cell types. Special organelles (myofibrils, neurofibrils, cilia, flagella, epithelofibril) are characteristic of a particular cell type. Depending on the structural features the organelles are divided into two groups: membrane organelles (mitochondria, Golgi complex, endoplasmic reticulum, lysosomes, plastids, vacuoles) and nonmembrane organelles (ribosomes, the cell center myofibrils, neurofibrils, epithelofibril).

Inclusions are non-permanent components of the cytoplasm. Their appearance and disappearance depends on the functional state of the cells. Inclusions are trophic, secretory, excretory and special. Trophic inclusions provide the supply of nutrients in the cell (protein pellets, starch, glycogen). Secretory inclusion are produced by glandular cells, they are necessary for the life of the other cells of the body (hormones, enzymes). Excretory included are products of catabolic reactions of cells not needed by the body (uric acid, calcium oxalate). Special inclusions include pigments (hemoglobin, melanin, lipofuscin).

The objective: 1. To study the structure and function of biological membranes, the main structural components of the cytoplasm. 2. To highlight the similarities and differences in the structure of plant and animal cells. 3. Read the microphotos of structural components of the cytoplasm.

Get ready to speak about:

1. Basic components of eukaryotic cells.
2. The cell wall, its structure in different species of living organisms. Cytoplasmic membrane, its structure and function.
3. The cytoplasm of the internal environment of the cell and its components:
 - hyaloplasm, its composition and properties;
 - organelles of general purpose, their structure and function;
 - organelles of special purpose, their structure and function;
 - inclusions, their classification and value in the cell.

Basic concepts and terms

Cell –elementary biological, structural and functional unit of living capable of self-regulation, self-reproduction and self-renewal.

Cytoplasm – part of the cell, including hyaloplasm, organelles and inclusions.

Hyaloplasm – heterogeneous colloidal solution cytoplasmic organelles providing the interconnection of all the cells and processes of its life.

Organelles –permanent components of the cytoplasm with a certain structure and to perform a function in the life of the cell.

Inclusions –non-permanent components of the cytoplasm, which are formed in the cell at certain times of her life.

Check tests

1. The structural components of cells include: a) cell membrane; b) nucleus; c) cytoplasm; d) pores.

2. Colloid solution where organelles and including are placed: a) karyoplasm; b) hyaloplasm; c) cytoplasm; d) protoplast.

3. Organelles of general purpose: a) endoplasmic reticulum, ribosomes, Golgi complex; b) flagella, cilia; c) centrosome, mitochondria, lysosomes; d) the plastids.

4. Organelles of special purpose: a) the ribosome; b) myofibrils, neurofibrils; c) tonofibrils; d) cilia, flagella.

5. Organelles which have a membrane structure: a) cell center; b) endoplasmic reticulum; c) Golgi complex, lysosomes; d) mitochondria.

6. Organelles with non-membrane structure: a) cell center; b) ribosome; c) myofibrils; d) Golgi complex; e) lysosomes.

7. The role of mitochondria in a cell: a) cytoplasmic inheritance; b) formation of inclusions; c) synthesis of ATP; d) proteolytic function.

8. The role of the endoplasmic reticulum in a cell: a) synthesis of proteins; b) synthesis of fats and carbohydrates; c) transport; d) formation of ATP.

9. The role of the lysosomes in a cell: a) synthesis of fats; b) cleaving of nucleic acids, proteins, lipids, carbohydrates; c) digestion of intracellular cytoplasmic components; d) autolysis of cells.

10. The structural unit of the Golgi complex: a) lysosome; b) dictyosome; c) of thylakoids; d) grains.

11. The role of the Golgi complex in a cell: a) involved in chromosome segregation to the poles; b) formation of lysosomes, vacuoles; c) concentration, dehydration and intracellular secretion seal products; d) secretory function.

12. Organisms in which cell center is present in the cells?a) animals; b) higher plants; b) bacteria; d) algae.

13. The role of the cell center in a cell:a) formation of a mitotic apparatus; b) provides uniform chromosome segregation to the poles in mitosis and meiosis; c) formation of lysosomes; d) excretory function.

14. The role of ribosomes in a cell: a) synthesis of fats; b) synthesis of proteins; c) digestion of intracellular cytoplasmic components; d) synthesis of carbohydrates.

15. The role of chloroplast in plant cells: a) involved in photosynthesis; b) provides uniform chromosome segregation in mitosis and meiosis; c) formation of lysosomes; g) transport.

16. The role of chromoplasts in plant cells: a) involved in photosynthesis; b) give the color of flowers and fruits; c) synthesis of ATP; d) transport.

17. The role of leucoplast in plant cells: a) are involved in photosynthesis; b) give the color of flowers and fruits; c) synthesis of ATP; d) storage of substances.

18. The role of vacuoles in plant cells:a) osmoregulatory; b) storage of certain substances; c) give the color of flowers and fruits; d) synthesis of ATP.

19. The role of neurofibrill: a) transport; b) makes chromosome segregation during mitosis; c) conducting a nervous impulse; d) storage of substances.

20. Cells which have flagella: a) ovum b) spermatozoa; c) red blood cells; d) the leukocytes.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreign learners of preparatory division. – Vitebsk VSMU, 2016. – P. 6–13.

Practical activities

I. Fill in the tables:

«Classification of organelles»

Two-membrane organelles	One-membrane organelles	Non-membrane organelles

«Organelles of general purpose»

Name of organelle	Features of structure	Functions in the cell

Theme №5.

Cell morphology. Structure and functions of the nucleus.

The nucleus is a main part of eukaryotic cells. Most of the cells have a single nucleus; some organisms have multy nuclei cells (bone marrow cells, liver).

Shapes and sizes of the nucleus are determined by the shape and size of the cell. The nucleus consists of karyolemm, karyoplasm, chromatin and nucleolus. Karyolemm has two membranes between which there is the cytoplasmic matrix (perinuclear space). External karyolemm membrane associated with the channels of the endoplasmic reticulum. Karyoplasm in their physical and chemical hyaloplasm composition is similar but different in high content of proteins and nucleic acids. Chromatin is a structural component of the nucleus, which is a complex of DNA with proteins. During cell division the chromatin spiralizes and forms chromosomes. Most clearly the structure of chromosomes can be seen in metaphase of mitosis. Each chromosome consists of two chromatids joined in the primary centromere. Primary constriction divides the chromosome into two arms. Depending on the location of the centromere there are four types of chromosomes: metacentric orequal (arms of equal length), submetacentric (one arm is slightly longer than the other) acrocentric (a very long one shoulder, the other is short) and telotsentric (one arm missing). Some chromosomes have a secondary constriction. All somatic cells of organism contain a certain number of chromosomes, and it is strictly constant for each species. The number of chromosomes in somatic cells is always diploid (2n). Sex cells have a single - haploid (n) number of chromosomes. The collection of the number, shape and size of chromosomes in somatic cells in the body is a karyotype. Nucleolus is round, highly compacted areas of the cell nucleus. The

nucleus may contain from one to ten nucleoli. Nuclei are formed of 80% protein and 10-15% of r-RNA, and a small amount of DNA. The nucleolus is a synthesis of ribosomal RNA and the formation of ribosomes.

The objective: 1. To study the structure and functions of the structural components of the nucleus. 2. To determine the types of chromosomes. 3. To view the features of the human karyotype.

Get ready to speak about:

1. The structural components of the nucleus
 - karyolemm;
 - karyoplasm;
 - chromatin;
 - nucleolus and its functions.
2. Morpho-functional characteristics of chromosomes.
3. Types and rules of chromosomes.
4. The haploid and diploid set of chromosomes. Karyotype.

Basic concepts and terms

Karyotype –combination of data on the number, structure and size of the chromosomes in somatic cells.

The diploid number of chromosomes (2n) –a paired set of chromosomes in somatic cells.

Haploid number of chromosomes (n) –a single set of chromosomes in sex cells.

Chromatin –structural component of the nucleus during interphase, is a complex of DNA with a protein.

Chromosomes – the main structural and functional elements of heredity, are carriers of genes.

Autosomes – chromosome pairs the same in men and women.

Sex chromosomes – chromosome pair which is different for male and female (X, Y).

Check tests

1. The structural components of a nucleus: a) cytolemma; b) karyolemm; c) karyoplasm; d) chromatin; e) nucleolus.

2. Types of chromosomes:a) metacentric; b) submetacentric; c) acrocentric; d) telocentric; e) subtelocentric.

3. Type of chromosomes in which the shoulders are of equal length: a) metacentric; b) submetacentric; c) acrocentric; d) telocentric.

4. Type of chromosomes where the shoulders have a slight difference in length: a) metacentric; b) submetacentric; c) acrocentric; d) telocentric.

5. Type of chromosomes where the shoulders are very different in length: a) metacentric; b) submetacentric; c) acrocentric; d) telocentric.

6. Type of chromosomes with only one shoulder: a) metacentric; b) submetacentric; c) acrocentric; d) telocentric.

7. Types of chromosomes: a) autosomes; b) somatic; c) sex; d) haploid.

8. Rules of chromosomes: a) pairing; b) individuality; c) continuity; d) the constancy of the number of chromosomes; e) similarity.

9. Number of autosomes in the human karyotype: a) 46; b) 23; c) 44; d) 22.

10. Number of sex chromosomes in human: a) 46; b) 44; c) 2; d) 23.

11. Chemical structure of chromatin: a) a protein; b) DNA; c) fats; d) carbohydrates; e) water.

12. Karyotype is: a) collection of all genes of the cell; b) collection of data on the structure, shape and number of chromosomes of somatic cells; c) distribution of chromosomes in a particular order with regard to their size, shape, location of the centromere.

13. The number of chromosomes in somatic human cells: a) 42; b) 46; c) 23; d) 22; e) 44.

14. The number of chromosomes in the germ cells of human: a) 42; b) 46; c) 23; d) 22; e) 44.

15. The diploid number of chromosomes ($2n$) is characteristic for: a) somatic cells; b) sex cells; c) polyploid cells; d) all of the body's cells.

16. Which cells have haploid set (n) of chromosomes: a) skin cells; b) sperm; c) neurons; d) ovum; e) erythrocytes.

17. The role of the secondary constriction of chromosome: a) synthesis of ATP; b) nucleolar organizer; c) regulation of cell metabolism; d) lysis of the nucleolus.

18. The chemical composition of the nucleolus: a) proteins; b) fats; c) carbohydrates; d) r-RNA.

19. The role of the nucleus in the cell: a) protein biosynthesis; b) storage and transmission of genetic information; c) synthesis of ATP; d) regulation of cell metabolism.

20. What human cells do not have nuclei? a) neurons; b) red cells; c) muscle; d) epithelium; e) leukocytes.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreign learners of preparatory division. – Vitebsk VSMU, 2016. – P. 13–16.

Practical activities

I. Fill in the table:

«Nucleus components»

Name	Features of structure	Basic functions
Karyolemm		
Karyoplasma		
Nuclei		
Chromatin		

Theme №6

Metabolism and energy exchange

All chemical reactions of synthesis and degradation, the underlying functioning of the body and ensuring its relationship with the environment is called metabolism. Metabolism includes plastic processes and energy metabolism. Plastic exchange (assimilation) is a set of fusion reactions, designed to form structural parts of cells and tissue (protein synthesis, photosynthesis, the synthesis of fats and carbohydrates). Energy metabolism, or (dissimilation) is a set of decomposition reactions (glycolysis, fermentation, respiration), accompanied excretory energy.

The objective: 1. To study the characteristics of the plastic exchange and transformation of energy in the cell, the basic steps of protein synthesis, photosynthesis, energy metabolism. 2. To solve situational problems in the encoding and decoding of genetic information. 3. Consider the features of the flow of information in a cell.

Get ready to speak about:

1. Metabolism is the basis of cell activity. Plastic metabolism of a cell.
2. Protein biosynthesis. The genetic code. Transcription. Translation.

3. Features of plastic and energy exchanges autotrophic organisms. Photosynthesis.

4. Conversion of energy in the cell. Stages of dissimilation. Fermentation. Breathing.

5. Role of ATP metabolism.

Basic concepts and terms

Assimilation (plastic exchange) – a set of fusion reactions designed to form structural parts of cells (synthesis of proteins, fats, carbohydrates, photosynthesis, chemosynthesis).

Dissimilation (energy metabolism) – a set of decomposition reactions involving energy formation.

Autotrophs – organisms that synthesize organic substances from inorganic (plants, some bacteria).

Heterotrophs – organisms used to power the complete organic matter (animals, fungi).

Mixotrophy – organisms with inorganic and organic substances mixed food (euglena green).

Transcription – copying genetic information from DNA to RNA by the principle of complementarity.

Translation – polypeptide synthesis in the ribosome on the mRNA template.

The genetic code – system of recording and storing genetic information as a sequence of nucleotides in DNA or RNA in some viruses. The genetic code is a triplet (three DNA nucleotides encode a single amino acid).

Codon – mRNA, consisting of three nucleotides encode a single amino acid.

Anticodon – triplet of tRNA that recognizes the process of protein synthesis at codon and RNA.

Photosynthesis – the process of conversion of the energy of sun light into chemical energy that flows in plants.

Check tests

1. Assimilation is: a) set of decomposition reactions of substances; b) set of fusion reactions in the cell; c) set of reactions of anabolism and catabolism.

2. Dissimilation is: a) set of decomposition reactions of substances; b) set of fusion reactions in the cell; c) set of reactions of anabolism and catabolism.

3. What is the genetic code?a) DNA triplet coding for one amino acid; b) triplet of r-RNA; c) triplet of t-RNA; d) triplet of m-RNA.

4. What is a codon?a) DNA triplet, b) r-RNA; c) triplet m-RNA; d) triplet tRNA.

5. What is an anticodon?a) DNA triplet; b) triplet m-RNA; c) triplet t-RNA; d) triplet r-RNA.

6. Start codon: a) AUG; b) UAG; c) AGG; d) UAA.

7. Codons-terminators: a) AUG; b) UAG; c) UAA; d) UGA.

8. Transcription is: a) synthesis of the polypeptide in the ribosome; b) the process of glucose splitting; c) a process of reading information from DNA to iRNA; d) a doubling of the DNA molecule.

9. Enzymes mediated transcription: a) a ligase; b) a nuclease; c) DNA polymerase; d) RNA polymerase.

10. Translation is:a) synthesis of polypeptide chains from the matrix into the ribosome and the m-RNA; b) a process of splitting glucose; c) a process of reading information from DNA to m-RNA; d) a doubling of the DNA molecule.

11. In the process of photosynthesis the energy is generated:a) in the form of ATP and NADPH H_2 ; b) by fermentation processes; c) by the processes of respiration.

12. Features of power supply during fermentation: a) high power output; b) go to the dissimilation of organic substances rich in energy; c) power output is small.

13. Features of energy formed during respiration: a) substances are broken down into final products; b) high power output; c) the products of dissimilation is not completely destroyed.

14. Phases of photosynthesis: a) preparation; b) light; c) dark.

15. Processes in the light phase of photosynthesis: a) synthesis of organic compounds from inorganic; b) photolysis of water; c) separation of the free oxygen; d) accumulation of energy in the form of ATP and NADP $\cdot H_2$.

16. The processes which takes place in the dark phase of photosynthesis: a) photolysis of water; b) synthesis of ATP; c) synthesis of organic compounds from inorganic.

17. Photosynthesis in plants occurs in: a) lysosomes; b) vacuoles; c) chloroplasts; d) leucoplasts.

18. Substances produced in the light phase of photosynthesis: a) enzymes; b) ATP; c) oxygen; d) glucose.

19. Glycolysis is a splitting process for: a) protein; b) lipids; c) glucose; d) fat.

20. What process allows the largest amount of energy is formed: a) glycolysis; b) photolysis; c) breathing; d) protein synthesis.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreign learners of preparatory division. – Vitebsk VSMU, 2016. – P. 23–28.

Practical activities

I. Solve the problem on the transcription:

№1. Detail of one of the chains has the following DNA nucleotide sequence AAAGATCGATCATATTCTGTGTTA. Write the structure of molecules and RNA formed in the transcription process in this region of the DNA molecule.

№2. The resulting portion of the molecule and RNA codon has the following composition: GCGACAUUUUCGCGUAGUAGAAUU. Determine which codes will encode the DNA-RNA and the sequence in which they are located.

No.3. One of the DNA strands with the sequence of nucleotides ATTGCTCAA used as a template for synthesis of messenger RNA. What will be the sequence of nucleotides and RNA?

№4. Portion of one strand of DNA consists of a sequence of codes: AGGGAATATATCCTCATATCGAGTAATTTTT. Determine which codons will be part-RNA encoded on this site and in what order they will be located.

№5. Determine the portion of the nucleotide sequence and RNA, which was formed at the site of the gene with the sequence of nucleotides: ATTCATCGATTCTCTTTCTAGGAGG.

№6. The zone includes the following DNA nucleotides: AATCAAATCTTATCTCTTAGTTAGAGTGATCATCTT. Write what free nucleotides will be used to build and RNA at the site of the DNA molecule, RNA, and if based on the principle of complementarity.

II. Solve the problem in the translation:

№1. The site of the molecule and RNA encoding the polypeptide portion has the following structure: ACCAUAGUCCAAGGAGCT. Determine the amino acid sequence of the polypeptide.

№2. Determine the amino acid composition of the polypeptide encoded by the mRNA following composition: CCUCCCCCACCG.

№3. Plot mRNA encoding a protein consisting of contiguous nucleotides: AACGACUAUCACUAUACCAACGAA. The composition and sequence of amino acids in the polypeptide chain.

№4. Part of m-RNA encoding one of the polypeptide chains of hemoglobin has the following structure: ACCAUUGACCAUGAA. The composition and sequence of amino acids in the polypeptide chain.

III. Solve the problem of the determination of the structure of DNA in the structure of protein molecules:

№1. Detail of the myoglobin protein molecule comprises the amino acids located in the following order: valine-alanine-glutamic acid-tyrosine-serine-glutamine. Write structure portion of the DNA molecule encoding the amino acid sequence.

№2. The polypeptide comprises the following amino acids: alanine, cysteine-leucine-serine-threonine-phenylalanine. Determine the structure of DNA region coding for the polypeptide chain.

№3. One of the polypeptide chains of insulin comprises 20 amino acids. Determine the portion of the structure of the DNA molecule encoding the polypeptide chain.

№4. The initial portion of the polypeptide chain of the bacteria E.coli consists of 10 amino acids arranged in the following order: What is the nucleotide sequence of a DNA region encoding a polypeptide chain?

№5. Starting from the audio circuit histone fraction has the following amino acid sequence: arginine-alanine-threonine-lysine. What is the structure of the initial fragments and double-stranded RNA and DNA?

Table.Messenger mRNA coding

1 st letter	2 nd letter				3 rd letter
	U	C	A	G	
U	Phenylalanine	Serine	Tyrosine	Cysteine	U
	Phenylalanine	Serine	Tyrosine	Cysteine	C
	Leucine	Serine	Stop	Stop	A
	Leucine	Serine	Stop	Tryptophan	G
C	Leucine	Proline	Histidine	Arginine	U
	Leucine	Proline	Histidine	Arginine	C
	Leucine	Proline	Glutamine	Arginine	A

	Leucine	Proline	Glutamine	Arginine	G
A	Isoleucine	Threonine	Asparagine	Serine	U
	Isoleucine	Threonine	Asparagine	Serine	C
	Isoleucine	Threonine	Lysine	Arginine	A
	Start-Metionine	Threonine	Lysine	Arginine	G
G	Valine	Alanine	Aspartic acid	Glycine	U
	Valine	Alanine	Aspartic acid	Glycine	C
	Valine	Alanine	Glutamic acid	Glycine	A
	Valine	Alanine	Glutamic acid	Glycine	G

Theme №7

Life cycle of cells

Period since the formation of cells by dividing the parent before the end of its own division of cells is called the life cycle. In highly differentiated cells life cycle lasts from the moment of formation of the cell until its death. Life cycle is divided in interphase (between divisions) and cell division itself. In the interphase takes a number of important physiological processes take place: DNA replication, synthesis of ATP, protein, fat and carbohydrates, growth and differentiation of cells, their function and prepare for the next division. Interphase consists of 3 periods: postmitotic (presynthetic), synthetic and premitotic (postsynthetic).

There are two main types of cell division: amitosis (direct division) and mitosis (indirect division).

The most common type of somatic cell division is mitosis. Mitosis is a way of cell division, which provides uniform distribution of genetic material between daughter cells and continuity of chromosomes in a number of cell generations. From a single diploid cell formed two cells with a diploid set of chromosomes as a result of mitosis.

Meiosis is a special form of mitosis, which is characterized by the presence of two divisions of the nucleus, resulting in a decrease in the number of chromosomes and the transition of cells from diploid to haploid state. The biological significance of meiosis is that it leads to the formation of gametes from haploid set of chromosomes, but also a source of variability combinative having great importance in organic evolution.

Amitosis is direct division of the interphase nucleus by the waist without the formation of chromosomes. At the nucleus of amitosis initially divided into two parts or more then cytoplasm divides and form two or more new cells. Sometimes cytoplasmic division does not occur in this case dual or multinucleus cells form. Amitosis is present in single-celled plants and some of the cells of multicellular animals (epithelial cells, liver and others.).

The objective: 1. To study the basic types and cell division characteristic of the life cycle. 2. To characterize the stages of mitosis and amitosis. 3. To study the types and forms of amitosis.

Get ready to speak about:

1. Life cycle of the cell. Interphase, its periods.
2. Cell division, its types and species.
3. Mitosis. Phases of mitosis, their characteristics. The biological significance of mitosis.
4. Meiosis, its characteristics. The biological significance of meiosis.
5. Endomitosis and polytene, mechanisms of their origin, biological significance.
6. Amitosis, its biological significance.

Basic concepts and terms

Life cycle of the cell – the period since the formation of the cell before the end of its own division or before her death.

Interphase – period between division.

Crossingover – exchange of equal portions of homologous chromosomes. It occurs in prophase of meiosis I, sometimes in mitosis. It is one of the mechanisms of combinative variability.

Mitosis – most common method of somatic cell division which leads to the formation of cells and genetically equivalent chromosomes continuity in several generations.

Meiosis – special form of mitosis, as a result of which the cells of the diploid state transformed into haploid that is necessary for the recovery of conjugation of the diploid number of chromosomes in a number of generations.

Amitosis – direct division of interphase nucleus by the waist without helix chromatin and formation of the mitotic apparatus.

Endomitosis – kind of mitosis in which there is an increase in the number of chromosomes fold haploid without subsequent division of the nucleus and cytoplasm. As a result of endomitosis formed polyploid cells.

Polytene – kind of mitosis in which there is repeated replication of DNA without altering the number of chromosomes. As a result of polytene chromosomes increase in size.

Check tests

1. The life cycle of cells: a) period from the occurrence of cells by dividing the parent until the end of her own division or her death; b) period between cell divisions; c) period from the occurrence of the cell before its own division.

2. The periods of interphase: a) presynthetic; b) mitotic; c) synthetic; d) postsynthetic.

3. Cytogenetic characterization of the nucleus in the G_1 period of interphase: a) $2n$: 2chr: 4c DNA; b) $2n$: 1chr: 2c DNA; a) n : 1chr: 2c DNA.

4. Cytogenetic characterization of the nucleus at the end of S - period in interphase: a) $2n$: 2chr: 4c DNA; b) $2n$: 1chr: 2c DNA; a) n : 2chr: 2c DNA.

5. Cytogenetic characterization of the nucleus in G_2 period in interphase: a) n : 2chr: 2c DNA; b) $2n$: 2chr: 4c DNA; a) $2n$: 1chr: 2c DNA.

6. The main types of cell division: a) polytene; b) amitosis; c) endomitosis; d) mitosis.

7. What division is characterfor human somatic cells? a) polytene; b) mitosis; c) meiosis.

8. The process of cell division that provides the formation of sex cells? a) mitosis; b) amitosis; c) meiosis; d) endomitosis.

9. The main processes in the prophase of mitosis: a) formation of helix chromatin and chromosomes; b) conjugation of chromosomes and crossing over; c) dissolution of the nucleolus and karyolemma; d) despiralization of chromosomes; e) differ centrioles to the poles, formed spindle thread.

10. Phase of mitosis in which the chromosomes of most helical located in the same plane: a) prophase b) metaphase; c) anaphase; d) telophase.

11. Phase of mitosis in which a discrepancy chromatids to the poles of the cell: a) prophase b) metaphase; c) anaphase; d) telophase.

12. The main processes in the telophase of mitosis: a) formation of helix chromatin and chromosomes; b) recovery of karyolemm; c) formation of the nucleolus; d) despiralization of chromosomes; e) division of the cytoplasm.

13. The biological significance of mitosis: a) there is a uniform distribution of genetic material between daughter cells; b) mother and daughter

cells have the same set of chromosomes; c) from somatic diploid cells are formed haploid reproductive cells.

14. The basic processes that occur in the chromosomes in prophase of meiosis I: a) helix; b) conjugation and crossingover; c) despiralization.

15. What moves to the poles in anaphase of meiosis I? a) chromosomes; b) chromatids.

16. What moves to the poles in anaphase of meiosis II? a) chromosomes; b) chromatids.

17. The biological significance of meiosis: a) decrease in cell number; b) the persistence of a number of generations of chromosomes in species that reproduce by sexual way; c) reduction by half the number of chromosomes in the cells formed; d) formation of new combinations of genes.

18. Which cells are formed after endomitosis? a) haploid; b) diploid; c) polyploid.

19. Types of amitosis: a) generative, degenerative, reactive; b) uniform, non-uniform, multiple; c) without cytotomy.

20. Forms of amitosis: a) generative, degenerative, reactive; b) uniform, non-uniform, multiple without cytotomy; c) endomitosis, polythene.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreignlearners of preparatory division. – Vitebsk VSMU, 2016. – P. 28–32.

Practical activities

I. Fill in the tables:

«Cytogenetic characterization of the cell nucleus in different periods of the life cycle»

Phase of life cycle of cells	Cytogenetic characterization of nucleus
Interphase: - presynthetic period - synthetic period - postsynthetic period	
Mitosis: - prophase	

- metaphase - anaphase - telophase	
Meiosis I: - prophase - metaphase - anaphase - telophase Meiosis II: - prophase - metaphase - anaphase - telophase	

«Comparative characteristics of mitosis and meiosis»

Sign	Mitosis	Meiosis
Number of cells formed after dividing the original cell		
Set of chromosomes in the formed cells		
Cells that are characterized by this division		
Biological significance		

**Theme №8.
Reproduction of organisms.**

Reproduction is a property of living organisms to reproduce itself. In the course of evolution formed two types of reproduction - asexual and sexual. Asexual reproduction is the way of reproduction, in which only one parent takes place to divide its somatic cells form new organisms that are genetically identical to the original parent. Asexual reproduction includes vegetative reproduction and spore formation.

Vegetative reproduction is a type of asexual reproduction in which a new organism is formed from part of the parent organism. Vegetative reproduction involves a binary division, schizogony, budding, fragmentation, multiplication of vegetative organs of plants and polyembryony.

Spore formation is asexual reproduction in which an organism develops from haploid cells (spore). In algae and fungal spores are formed by mitosis of any cell; higher plants – from diploid cells by meiosis in special multicellular bodies (sporangia). Spore formation is observed at a number of plants, fungi and parasitic protozoa.

In sexual reproduction, in contrast to the asexual participate two parental individuals or sex cells (gametes). To include the conjugation of sexual reproduction, copulation and parthenogenesis. The formation of sex cells (gametogenesis) appears in the gonads through meiosis. The formation of male sex cells occurs in the testes (spermatogenesis), and women - in the ovaries (oogenesis). Gametogenesis consists of four periods: reproduction, growth, maturation and formation. During the breeding season the primary germ cells (spermatogonia and oogonia) divides by mitosis. In the period of growth, they increase in size, forming spermatocytes and oocytes I order. In the period of maturation germ cells divide by meiosis. After the first meiotic division formed spermatocytes and oocytes II order. After meiosis II of spermatogenesis forms four spermatids that enter a period of formation and transformed into sperm. In oogenesis after meiosis II produced one egg and four calf reduction. The period of formation in oogenesis virtually is non-existent. The resulting sex cells involved in fertilization, or perish.

Fertilization preceded insemination is a set of processes that ensure the meeting of sperm and egg. Insemination is outside, what is happening in the aquatic environment (fish, amphibians), and the internal, what is happening in the female genital tract (in reptiles, birds, mammals).

The objective: 1. To study the basic types and forms of reproduction, gametogenesis particular, the structure of germ cells. 2. To specify the differences oogenesis of spermatogenesis characterized gametogenesis stages and types of eggs. 3. To view the features of polyembryony in human.

Get ready to speak about:

1. Reproduction is a universal property of living things. Types of reproduction.
2. Asexual reproduction
–vegetative reproduction in unicellular and multicellular organisms;

–polyembryony as a form of asexual reproduction in organisms that reproduce sexually;

–sporulation.

3. Sexual reproduction, his views.

4. Features of sexual reproduction in multicellular animals

–gametogenesis, his periods;

– structure of germ cells;

– insemination and fertilization.

Basic concepts and terms

Conjugation– type of sexual process in which there is an exchange of genetic information without increasing the number of organisms and the formation of gametes.

Copulation – kind of sexual reproduction in which haploid gametes merge to form a diploid zygote.

Parthenogenesis – kind of sexual reproduction in which an organism develops from an unfertilized egg.

Polyembryony – kind of asexual reproduction in embryogenesis organisms that reproduce sexually, in which the zygote is formed from a few embryos.

Schizogony – asexual reproduction in the form of single-celled animals, in which there is division multiple cores with subsequent division of the cytoplasm, resulting from a single parent organism produces a lot of subsidiaries.

Gamete – sex cell which provides the appearance of a new individual at the confluence of the opposite transfer gametes and genetic information from parents to offspring.

Gametogenesis –formation of gametes.

Insemination –processes to ensure the meeting of sperm and egg.

Fertilisation –process of fusion of gametes, resulting in a zygote.

Zygote – the diploid cell that is formed by the merger of male and female sex cells.

Check tests

1. Types of organisms reproduction: a) asexual; b) sexual; c) amitosis; d) mitosis.

2. Types of asexual reproduction: a) parthenogenesis; b) vegetative; c) sporulation; d) conjugation.

3. Forms of vegetative reproduction: a) binary division by mitosis or amitosis; b) the vegetative organs of plants; c) fragmentation, budding; d) polyembryony.

4. Forms of sexual reproduction: a) polyembryony; b) conjugation; c) copulation; d) parthenogenesis.

5. Features of asexual reproduction: a) one parent takes place; b) development goes from the zygote; c) development of an organism goes from somatic cells; d) subsidiaries of the hereditary material of individuals do not differ from the parent.

6. Features of sexual reproduction: a) take part two parental individuals; b) updated the hereditary material; c) one parent is involved individual; d) development comes from somatic cells.

7. The advantages of sexual reproduction over asexual: a) fully offspring like the parents; b) indicator of reproduction is higher; c) update occurs genetic material; d) increasing the adaptive opportunities of the organism.

8. Conjugation is: a) formation of sex cells; b) merging of sex cells; c) exchange of genetic information between individuals of different species; d) sexual process by which genetic information is exchanged between individuals of the same species.

9. Parthenogenesis is: a) merger of the egg and sperm; b) convergence of sperm and egg; c) development of the egg after fertilization; d) development of the egg without fertilization.

10. Gametogenesis is: a) divide of somatic cells; b) reproduction of gametes; c) formation of gametes; d) merger of gametes; e) meiotic cell division.

11. During reproduction period in gametogenesis cells divides by: a) mitosis; b) meiosis; c) amitosis; d) fragmentation; e) schizogony.

12. During the period of maturation in gametogenesis cells divides by: a) mitosis; b) meiosis; c) amitosis; d) fragmentation; e) schizogony.

13. Periods of spermatogenesis: a) reproduction; b) formation; c) growth; d) maturation.

14. Periods of oogenesis: a) reproduction; b) formation; c) growth; d) maturation.

15. Cytogenetic characterization of oogonia and spermatogonia: a) $2n: 1chr: 2c$ DNA; b) $2n: 2chr: 4c$ DNA; a) $n: 2chr: 2c$ DNA.

16. Cytogenetic characterization of sperm and eggs: a) $n: 1chr: 1c$ DNA; b) $n: 2chr: 1c$ DNA; a) $n: 2chr: 2c$ DNA.

17. Characteristic features of egg: a) big, mobile; b) big, immobile; c) absence of centrosome; d) big amount of cytoplasm; e) presence of acrosome.

18. Characteristic features of sperm:a) mobile; b) immobile; c) it has a round or oval shape; d) has a head, a neck and a tail; e) has the acrosome.

19. Insemination is: a) merging of the egg and sperm; b) processes to ensure meeting of gametes; c) release of an egg from the ovary; d) sexual process.

20. Fertilization is: a) formation of sex cells; b) exchange of genetic information between individuals of different species; c) process of maturation of germ cells; d) fusion of sex cells to form the zygote.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreignlearners of preparatory division. – Vitebsk VSMU, 2016. – P. 32–36.

Practical activities

I.Fill in the table:

«Differences of spermatogenesis oogenesis in mammals»

Signs	Spermatogenesis	Oogenesis
Finish of reproduction period		
Duration period of growth		
Number of sex cells formed as a result of one of the initial gametogenesis		
Availability of formation period		

«Types and kinds of organismsreproduction »

Name of the organism	Type of reproduction	Kinds of reproduction
1. Amoeba		
2. Plasmodium malariae		
3. Infusoria		
4. Hydra		
5. Earthworm		
6. Potato		

7. Fern		
8. Bee		
9. Man		

Theme №9

Individual development of organisms

Ontogenesis is individual development of an organism from the formation of the zygote to death. Ontogenesis includes two periods: embryonic and postembryonic.

Embryonic development is a period of ontogenesis from the moment of zygote formation till the occurrence of the organism from the egg shells or before birth. The embryonic period consists of crushing, gastrulation, histogenesis (tissue formation) and organogenesis.

After birth of the organism or its exit from the egg shells begins postembryonic (postnatal) period of ontogenesis which continues until the death of the organism. In the post-embryonic period of ontogenesis stages are distinguished: prereproductive (from birth to puberty), reproductive (sexual development and reproduction) and postreproductive (aging period).

There are two types of individual development (direct and indirect). The direct type of development is a development in which the individual after leaving the egg membranes or after birth has no provisory bodies, similar to the parent, but are smaller, functional and structural immaturity of organs and organ systems. In the indirect type of organism after leaving the egg membranes is very different from the adult, extends one or more larval stages and has provisionally authorities. Indirect development may be incomplete metamorphosis (egg - larva - adult organism) and with complete metamorphosis (egg - larva - pupa - adult organism).

The objective: 1. To study the basic laws of embryonic and postembryonic development of an organism derived germ layers. 2. To specify periods of ontogenesis, embryogenesis, giving them a characteristic to distinguish direct from indirect development. 3. To view the features of human embryonic development.

Get ready to speak about:

1. The ontogenesis and its periods.
2. Embryonic development:
 - crushing;
 - gastrulation;
 - histo- and organogenesis;
 - embryonic membranes of the body, their role.
3. The postembryonic development, its characteristics:
 - direct type of development;
 - indirect development with complete and incomplete metamorphosis.
4. The adverse effects of alcohol, nicotine, drugs and other toxic substances on the development of the human body.

Basic concepts and terms

Ontogenesis – individual development of an organism from the moment of zygotes to death.

Embryonic development – the period since the formation of the zygote before the release of the body from the egg shells or his birth.

Postembryonic development – the period since the release of the body from the egg shells or birth until his death.

Fragmentation – the process of division of the zygote by mitosis, resulting in a single layer formed embryo (blastula).

Gastrulation – the formation of a single-layer double-layer embryo (gastrula).

Histogenesis – the process of the formation of tissues.

Organogenesis – the formation of organs.

Blastula – single-layered embryo.

Blastocoel (primary body cavity) – cavity located inside the blastula.

Gastrula – double layer embryo.

Embryo – an animal or a person in the early stages of embryonic development.

Foetus – the human body in the period from the 9th week of embryonic development before birth.

Ectoderm – external germinal leaf.

Endoderm – internal embryonic leaf.

Mesoderm – the average embryonic leaf, located between the ecto- and endoderm.

Check tests

1. Ontogenesis is: a) development of an organism from the moment of zygote formation to death; b) development of an organism from birth to death; c) development of an organism from fertilization to birth.

2. Periods of ontogenesis: a) preembryonic; b) embryonic; c) postembryonic; d) period of growth.

3. Embryonic period is: a) period from birth to death of the organism; b) period of growth of the organism; c) whole period of development of the organism; d) period since the formation of the zygote before the release of the body of the egg or the birth.

4. Processes occurring in the embryonic period: a) crushing; b) gastrulation; c) histo- and organogenesis; d) gametogenesis.

5. A single-layer embryo resulting from cleavage of the zygote: a) blastula; b) foetus; c) gastrula; d) neurula.

6. Types and kinds of fragmentation: a) full (even and uneven); b) incomplete (uneven and discoid); c) total (surface and discoid); d) incomplete (surface and discoid).

7. The process of forming a dual layer of the embryo called: a) neurulation; b) crushing; c) gastrulation; d) induction.

8. Gastrula is: a) cavity of the fetus; b) two-layer embryo; c) single-layer embryo; d) three-layered embryo.

9. Derivatives of the ectoderm: a) nervous system; b) organs of sensation, the epidermis of the skin and its derivatives; c) urogenital system; d) light.

10. Mesoderm derivatives: a) the musculoskeletal system, all kinds of connective tissue; b) the blood and lymphatic systems; c) the senses; d) urogenital system.

11. Derivatives of endoderm: a) nervous system; b) the epithelium of the midgut; c) respiratory system; d) the digestive gland.

12. Two-layer animal include: a) segmented worms; b) coelenterates; c) molluscs; d) flatworms.

13. Protostomes are: a) worms; b) molluscs; c) arthropods; d) chord.

14. Postembryonic period is: a) the period from the release of the body of the egg, or birth to death; b) the period of growth; c) the whole period of development of the organism; d) a period of growth and differentiation.

15. Periods of postembryonic development: a) embryo; b) prereproductive; c) reproductive; d) postreproductive.

16. Types of postembryonic development: a) indirect (with complete and incomplete metamorphosis) b) direct with complete metamorphosis; c) direct; d) direct with incomplete metamorphosis.

17. Development stage of incomplete metamorphosis: a) egg; b) larva; c) pupa; d) imago (adult).

18. Stages of development of the organism in full metamorphosis: a) egg; b) larva; c) pupa; d) imago (adult).

19. Characteristics of direct type of development: a) after the release of the egg membranes individual goes further stage of development and has a larval organs; b) after the release of the egg membranes or the birth of individual differs from the adult stage smaller and immature organ systems.

20. Characteristics of indirect type of development: a) after the release of the egg membranes specimen is similar to the adult organism, but are smaller and immature organ systems; b) after the release of the egg membranes specimen is very different from the adult, extends further stage of development and has a larval organs; c) characteristic of yolk-rich eggs.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreign learners of preparatory division. – Vitebsk VSMU, 2016. – P. 36–38.

Practical activities

I. Fill in the table:

«Histo- and organogenesis»

Embryonic leaf	Tissues and organs formed
Ectoderm	
Endoderm	
Mesoderm	

Theme №10

Bases of cytology, reproduction and individual development (summing-up class)

The objective: 1. Determine the extent of learning the basics of Cytology, reproduction and individual development of organisms. 2. To solve situational problems in the encoding and decoding of genetic information to apply this knowledge to explain biological phenomena.

Get ready to speak about:

1. Biology is the science of nature.
2. Evolutionary caused levels of the organization living matter.
3. Properties of living things.
4. Acellular and cellular life forms. The concept of prokaryotes and eukaryotes.
5. Cytology is the science of the cell.
6. The cell theory, the main stages of its development. The current state of the cell theory.
7. The content of chemical elements in the cell, their classification.
8. Inorganic and organic substances of the cell.
9. The water content and its role in the life of the cell.
10. Mineral salts, their significance for the organism.
11. Carbohydrates. Mono-, di- and polysugars. The biological role of carbohydrates.
12. Fats, their biological role.
13. Proteins, particularly their structure. The role of proteins in the cell.
14. Nucleic acids, their types.
15. The structure of the DNA molecule. Localization of DNA in the cell. DNA replication.
16. The structure of RNA. RNA kinds, their characteristics.
17. ATP, especially its structure. The biological role in the cell.
18. Basic components of eukaryotic cells.
19. The cell wall, its structure in different species of living organisms. Cytoplasmic membrane, its structure and function.
20. The cytoplasm of the internal environment of the cell and its components:
 - hyaloplasm, its composition and properties;
 - organelles of general purpose, their structure and function;
 - organelles of special purpose, their structure and function;
 - inclusions, their classification and value in the cell.
21. The structural components of the nucleus
 - karyolemm;
 - karyoplasm;
 - chromatin;
 - nucleolus and its functions.
22. Morpho-functional characteristics of chromosomes.
23. Types and rules of chromosomes.
24. The haploid and diploid set of chromosomes. Karyotype.

25 Metabolism is the basis of cell activity. Plastic metabolism of a cell.

26. Protein biosynthesis. The genetic code. Transcription. Translation.

27. Features of plastic and energy exchanges autotrophic organisms.

Photosynthesis.

28. Conversion of energy in the cell. Stages of dissimilation. Fermentation. Breathing.

29. Role of ATP metabolism.

Life cycle of the cell. Interphase, its periods.

30. Cell division, its types and species.

31. Mitosis. Phases of mitosis, their characteristics. The biological significance of mitosis.

32. Meiosis, its characteristics. The biological significance of meiosis.

33. Endomitosis and polytene, mechanisms of their origin, biological significance.

34. Amitosis, its biological significance.

35. Reproduction is a universal property of living things. Types of reproduction.

36. Asexual reproduction

– vegetative reproduction in unicellular and multicellular organisms;

– polyembryony as a form of asexual reproduction in organisms that reproduce sexually;

– sporulation.

37. Sexual reproduction, its views.

38. Features of sexual reproduction in multicellular animals

– gametogenesis, its periods;

– structure of germ cells;

– insemination and fertilization.

Literature.

Bekish V.J., Zoryna V.V. Biology: for foreign learners of preparatory division. – Vitebsk VSMU, 2016. – P. 4–38.

Practical activities

I. Solve the problem in the transcription:

№1. Detail of one of the chains has the following DNA nucleotide sequence TTTCGTTATCTAAAAGATCACATAT. Write the structure of molecules and RNA formed in the transcription process in this region of the DNA molecule.

№2. One of the DNA strands with the sequence of nucleotides TGATCTCATACC used as a template for synthesis of messenger RNA. What will be the sequence of nucleotides and RNA?

№3. Portion of one strand of DNA consists of a sequence of codes: TACGAGTAATTAGGGAATATACCAT. Determine which codons will be part-RNA encoded on this site and in what order they will be located.

№4. To determine the nucleotide sequence portion of the molecule and the RNA, which was formed on the portion of the gene with the nucleotide sequence: ATTCACGATCCTTCCTAGGAGG.

№5. The plot strand of DNA serving as a template for the formation of mRNA, comprises the following nucleotides: CTTAGTTAGAGTCAACTTACGACACT. Write what nucleotides will be used to build and RNA.

II. Solve the problem in the translation:

№1. Plot and RNA molecules, encoding a portion of the polypeptide has the following structure: CUCUCAGCCUAGGAA. To determine the amino acid sequence of the polypeptide.

№2. Plot mRNA encoding the protein comprises consecutive nucleotides: UACCACGACUAUCAGGACUACAAC. The composition and sequence of amino acids in the polypeptide chain.

№3. To determine the amino acid composition of the polypeptide encoded by the mRNA following composition: AAACCUCCAGCCACG.

№4. Plot mRNA encoding one of the polypeptide chains has the following structure: GAAGACACCUUUCAU. The composition and sequence of amino acids in the polypeptide chain.

III. Solve the problem of the determination of the structure of DNA in the structure of protein molecules:

№1. A fragment of the protein molecule comprises the amino acids arranged in the following order: phenylalanine-valine-alanine-glutamic acid-serine-lysine. Write structure portion of the DNA molecule encoding the amino acid sequence.

№2. Starting single polypeptide chain has the following amino acid sequence: arginine-lysine-threonine-alanine-phenylalanine. What is the structure of the initial fragments and double-stranded RNA and DNA?

№3. Hormone polypeptide chain comprises the following amino acids: leucine-phenylalanine-glycine-glutamine-isoleucine-tyrosine-cysteine.

Determine the portion of the structure of the DNA molecule encoding the polypeptide chain.

Theme №11

Genetics as a science of heredity and diversity. Patterns of inheritance of traits

Genetics is a science that studies the laws of heredity and diversity of organisms. The subject of genetics is the material basis of heredity and diversity (genes and chromosomes). The genetics of the following tasks:

1. Study the problem of storage of genetic information.
2. Study of mechanisms of transmission of genetic information from cell to cell, from generation to generation.
3. Study of mechanisms of realization of genetic information.
4. Study of mechanisms of change in genetic information.

The main methods are cytogenetic, genealogical, twins, population-statistic, biochemical, ontogenetic.

Cytogenetic method is based on microscopic examination of the chromosomes. This method allows setting the hereditary human diseases associated with changes in the number and structure of chromosomes.

Genealogical method is a method of constructing and studying the pedigree. Genealogical method allows determining the type of inheritance of the trait to determine the probability of a sick child.

Twins method is based on the study of twins. It allows you to figure out the role of environment and genotype in the formation of symptoms.

Population-statistical method used for studying the frequency of genes in populations.

Biochemical method used to study the chemical composition of the cells and body fluids.

Ontogenetic method used to study the manifestation of symptoms of the individual in the process of development. Its aim: early diagnosis and timely prevention of hereditary diseases.

The objective: 1. To study the basic concepts of genetics, its subject, objectives and methods; patterns of inheritance established by Mendel. 2. To solve problems in the mono- and dihybrid cross. 3. To view the features of the study of human genetics.

Get ready to speak about:

1. Genetics as a science, its subject, objectives and methods.
2. Basic concepts of genetics: heredity, inheritance, variability, gene alleles, homozygote, heterozygote, hemizygote, dominant and recessive genes, genotype, gene phenotype, the gene pool.
3. Laws of succession monohybrid cross:
 - law of uniformity of hybrids of the first generation;
 - law of segregation;
 - law of the "purity of gametes" U. Betsona and cytological bases;
 - test cross.
4. Laws of succession di- and polyhybrid crossing. Law of the independent inheritance and combining features of its cytological bases.

Basic concepts and terms

Genetics – science of heredity and variation in living organisms.

Gene – DNA molecule or a portion of some RNA viruses, encodes the primary structure of the polypeptide molecules or transport of ribosomal RNA.

Alleles – pair of genes located in the same areas of homologous chromosomes and defining contrast (alternative) characteristics.

Dominant gene – gene that controls the trait manifested in the hybrids in the first generation.

Recessive gene – gene that controls the trait is not manifested (depressed) hybrids in the first generation.

Genotype – set of genes of a cell or organism that determine its development.

Genome – set of genes haploid sets of chromosomes.

Gene pool – set of genes of all individuals in the population.

Homozygote – organism with identical alleles of one gene, for example, both alleles are dominant (AA) or both recessive (aa).

Heterozygote – organism that has different alleles of one gene - one dominant, the other - recessive (aa).

Hemizygote – organism having one allele of gene (X^aY).

Heredity – property organisms store and transmit characteristics and properties among generations.

Inheritance – method of transmitting signs in a number of generations.

Phenotype – set of characteristics and properties of the organism formed during the interaction of genotype with the environment.

Check tests

1. Genetics is: a) science of plants; b) science of heredity and diversity; c) science of the cell.

2. Heredity is: a) properties of the organisms pass on their features and characteristics of a number of generations; b) science of heredity and diversity; c) variety of traits in organisms.

3. Allelic genes are called: a) monitoring alternative features; b) localize in different pairs of homologous chromosomes; c) locate in the same locus of homologous chromosomes.

4. Genotype is: a) set of genes of an organism; b) single sign; c) combination of features of an organism.

5. The phenotype is: a) set of genes of an organism; b) single sign; c) combination of features of an organism.

6. Genome is: a) science of heredity and variation; b) set of genes haploid sets of chromosomes; c) characteristic.

7. Test cross is conducted?: a) to determine the genotype of an individual with a dominant feature; b) to determine the genotype of individuals with recessive trait; c) to determine the gametes in individuals with recessive trait.

8. Method used to study chromosomes: a) cytogenetic; b) ontogenetic; c) biochemistry.

9. Method used to study gene frequency in the population: a) cytogenetic; b) population-statistic; c) biochemistry.

10. Method used to study the pedigree: a) genealogical; b) ontogenetic; c) biochemistry.

11. Splitting genotype in F_2 at monohybrid cross: a) 3: 1; b) 1: 2: 1; c) 9: 3: 3: 1.

12. Digestion in phenotypically monohybrid cross F_2 : a) 3: 1; b) 1: 1; c) 9: 3: 3: 1.

13. Digestion in phenotypically dihybrid cross F_2 : a) 3: 1; b) 1: 1; c) 9: 3: 3: 1.

14. How many gametes form organism with the AA genotype: a) 1; b) 2; c) 4.

15. How many gametes form a body with genotype Aa: a) 1; b) 2; c) 4.

16. How many gametes form body with AaBb genotype: a) 1; b) 2; c) 4.

17. How many gametes form a body with genotype AaBB: a) 1; b) 2; c) 4.

18. Hybridization in which individuals are analyzed on single pair of alternative features: a) monohybrid; b) dihybrid; c) polyhybrid.

20. Hybridization in which individuals are analyzed on two pairs of alternative features: a) monohybrid; b) dihybrid; c) polyhybrid.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreign learners of preparatory division. – Vitebsk VSMU, 2016. – P. 38–45.

Practical activities

I. To solve the problem on monohybrid cross:

№1 In human, the gene polydactyly dominates the normal structure of the hand. Determine the probability of children birth with polydactyly in a family where both parents are heterozygous. In a family where one parent has a normal structure of the hand, and the second – with polydactyly, the child was born with a normal structure of the hand. What is the probability of the next child, too, no anomaly?

№2. "Chicken" blindness controlled by a dominant gene. A woman suffering from "chicken" blindness married to a healthy man. All children (6) inherited disease. The sister of a woman, also suffering "chicken" blindness married to a healthy man, and from this marriage had three healthy children and one with a "chicken" blindness. What is the genotype of the sisters and their parents, knowing that both of them have suffered "chicken" blindness

№3. Myopia is inherited as a dominant trait. Determine the probability of the birth of children with abnormalities in a family where the father is heterozygous, and the mother does not suffer myopia.

№4. The lack of small molars inherited as a dominant autosomal trait. What are the chances of children born with an abnormality in a family where both parents were heterozygous for the analyzed attributes?

№5. Phenylketonuria is inherited as a recessive trait. Parents are heterozygous for phenylketonuria. What is the probability of a sick child? Wife heterozygous for phenylketonuria, and her husband is homozygous for the normal allele of this gene. What is the probability of a sick child?

№6. The gene causes a hereditary human anophthalmia (eyeless), allelic gene A causes the normal development of the eye, in heterozygotes eyeballs reduced. The couple are heterozygous for the gene A. Determine the splitting of the phenotype and genotype in the progeny. The man, heterozygous for the

gene A married woman with normal eyes. What is the expected splitting of the phenotype in the progeny?

II. Solve the problem on dihybrid cross:

№1. The man brown eye color blue dominates, and the ability to better hold your right hand over the left-handedness dominates, the genes of the two signs are in different pairs of chromosomes.

Brown-eyed blue-hander marries lefties. What symptoms can be expected for children if a male homozygous for both featured and if he is heterozygous?

The blue-eyed righty marries brown-eyed righty. They had two children – a blue-eyed left-handed and right-handed. From the second marriage of the men on the other right-handed were born 9 brown-eyed children. They were all right-handed. What are each of the three genotypes of the parents?

Brown-eyed righty married blue-handerrighty. Their first child is left-handed and has blue eyes. What signs will have further descendants of the couple?

№2. The man myopia dominates normal vision, and brown eyes over the blue. The only child myopic brown-eyed parents have blue eyes and normal vision. Set genotypes all three members of this family. We sighted the blue-eyed woman from marrying brown-eyed man with normal vision born eyed myopic child. Can I install the genotype of the parents? The blue-eyed myopic man, whose mother had normal vision, brown-eyed woman married with normal vision. The first child of this marriage eyed and myopic, the second - the blue-eyed, myopic. Set genotypes of parents and children. Brown-eyed man with normal vision married to blue-sighted woman. They had three sons: brown-eyed with normal vision, blue-eyed myopia and normal vision. Determine the genotypes of the parents and children.

№3. In human, deaf-mutism is inherited as an autosomal recessive trait, and gout - as a dominant trait. Both genes are in different pairs of chromosomes. Determine the probability of the deaf child with a predisposition to gout have a deaf-mute mother, but does not suffer from gout, men with normal hearing and speech suffering from gout.

№4. In humans, I-I'm blood group is determined by a recessive gene I^O , II - I - gene I^A , III-I - gene I^B , IV-I - I^A and I^B genes together. Parents have II and III blood group and are heterozygotes. What blood group can expect their children? The mother blood group I, his father IV. Can children inherit the blood group of one of their parents? The boy's blood group I, and his sister IV. Determine the blood group of parents.

Theme №12

Genetics of sex. Linked inheritance

Sex is a combination of morphological and physiological characteristics of the organism providing its sexual reproduction and transfer of genetic information due to the formation of gametes. Sex controlled the same sex chromosomes, constitutes one type of gamete called homogametic.

Sex, controlled by different chromosomes, producing two types of gametes called heterogametic.

Sex of the body depends on a combination of sex chromosomes in the zygote after fertilization.

There are four versions of chromosomal sex determination:

- the female is homogametic – ♀ XX x ♂ XY (in mammals and humans)
♀XX X ♂XO (for bugs);
- when female is heterogametic – ♀ ZW x ♂ ZZ (butterflies)
♀ ZO x ♂ ZZ (in birds)

The symptoms that are inherited through sex chromosomes are called sex-linked. In humans, sex-linked traits such as hemophilia (incoagulability blood), blindness (red-green blindness), and others.

Genes are engaged not only in sex chromosomes, but in the autosomes. The joint inheritance of genes in one chromosome called linked genes. In gametogenesis, crossing-over occurs between homologous chromosomes, one speaks of an incomplete linked genes.

Incomplete adherence is characteristic of plants and animals. In gametogenesis, crossing-over does not take place, we speak of a full clutch of genes (*Drosophila* males, female silkworm). Crossover frequency depends on the distance between the genes, it is usually expressed as a percentage. Gametes with chromosomes that have undergone crossover is called crossover, not endured – noncrossover. Linked genes examined T. Morgan. He formulated the following rules which are based on results: the genes localized in one chromosome are inherited is linked, and the adhesive force depends on the distance between them.

The objective: 1. To study the mechanisms of sex determination, types of linked inheritance, the basic provisions of the chromosome theory of heredity.

2. To solve problems on the linked inheritance features. 3. To view the human diseases, sex-linked.

Get ready to speak about:

1. Genetics of sex.
2. Sex-linked inheritance.
3. Linked inheritance. Full and partial grip of genes in the chromosomes. Rule T. Morgan.
4. Chromosomal theory of heredity.
5. Interaction of single genes and different alleles.

Basic concepts and terms

Sex – set of morphological and physiological characteristics, ensuring reproduction of organisms and the transfer of genetic information due to the formation of gametes.

Autosomes – chromosome pairs of the same in men and women.

Sex chromosomes – chromosome pair, which is different for male and female karyotype.

Homogametic sex – the sex, having a same sex chromosomes and forming one type of gamete.

Heterogametic sex – the sex, having different sex chromosomes and produces two types of gametes.

Linked genes – genes shared inheritance, which are situated in one chromosome.

Crossover – exchange of equal portions of homologous chromosomes.

Cross group – set of genes located on the same chromosome.

Check tests

1. Pairs of chromosomes are the same in men and women:a) autosomes; b) sex chromosomes; c) somatic.

2. Chromosomes which are different in male and female karyotype: a) autosomes; b) sex chromosomes; c) somatic.

3. Sex which has identical sex chromosomes:a) homogametic; b) heterogametic; c) heterozygous.

4. Sex which has different sex chromosomes: a) homogametic; b) heterogametic; c) heterozygous.

5. Chromosomal sex determination during female homogametic: a) ♀XX x ♂XY; b) ♀ZW x ♂ZZ; c) ♀XX x ♂XO; d) ♀Z0 x ♂ZZ.

6. Chromosomal sex determination during female heterogametic: a) ♀XX x ♂XO; b) ♀ZW x ♂ZZ; c) ♀ZO x ♂ZZ; d) ♀XX x ♂XY.

7. Organisms that have female homogametic: a) birds; b) drosophila; c) a butterfly; d) the human and mammals.

8. Organisms that have female heterogametic: a) birds; b) drosophila; c) a butterfly; d) the human and mammals.

9. What means sex-linked inheritance? a) gene controlling feature is localized in autosomes; b) gene controlling feature is localized in the X or the Y chromosome; c) gene controlling feature is localized in autosomes and sex chromosomes.

10. Signs of sex-linked inheritance:a) hemophilia; b) hair color; c) color-blindness.

11. Types of autosomal linked inheritance: a) independence; b) complete; c) incomplete.

12. What kind of inheritance in genes characterized in human autosomes? a) complete; b) incomplete.

13. In what linked genes observe crossing over? a) independence; b) full; c) incomplete.

14. The phase of meiosis I in which crossover occurs: a) prophase; b) metaphase; c) anaphase; d) telophase.

15. What genes form a group cohesion? a) genes are located in one chromosome; b) allelic genes; c) genes located on different chromosomes.

16. The number of coupling groups genes in humans: a) 46; b) 2; c) 23.

17. What forms of gametes with the genotype AaBb body with full cohesion of genes?a) 1; b) 2; c) 4.

18. How many gametes form a body with genotype AaBb by incomplete cohesion of genes? a) 1; b) 2; c) 4.

19. How many gametes form homogametic sex? a) 1; b) 2; c) 4.

20. How many gametes form heterogametic sex? a) 1; b) 2; c) 4

Literature

Bekish V.J., Zoryna V.V. Biology: for foreignlearners of preparatory division. – Vitebsk VSMU, 2016. – P. 45–49.

Practical activities

I. Solve the problems.

№1. Classic hemophilia is transmitted as recessive, linked to the X chromosome sign. A man with hemophilia, marries a normal woman, whose

father had hemophilia. Determine the probability of a birth in the family of healthy children.

№2. A man with hemophilia, marries a woman not having this disease. They are born normal sons and daughters who marry persons with hemophilia. Detect whether the grandchildren again hemophilia and what is the probability of patients in the family's sons and daughters?

№3. In humans, the gene that causes a form of color blindness or color blindness, is localized on the X chromosome. Condition disease caused by a recessive gene, the health - dominant. The girl has normal vision, whose father suffered from color blindness, marries a normal man, whose father was also a color blindness. What vision can be expected in children of this marriage?

№4. Classical hemophilia c h, and blindness are inherited as a recessive trait linked to the X chromosome. The distance between the genes of h and with 9.8 defined in map units. The woman, whose mother is colorblind, and her father - haemophilia marries a man suffering from both diseases. Determine the probability of the birth of children in the family at the same time with both anomalies.

№5. In tomatoes tall stem dominates the dwarf, and spherical shape of the fruit of the pear, the genes of stem height and shape of the fruit, and are linked to each other at a distance of 20 map units. Crossed heterozygous for both featured a dwarf plant having a pear-shaped fruit. What to expect from the offspring of this cross?

№6. The girl, whose father suffers from both hemophilia and color blindness, and the mother is healthy and comes from a prosperous family of these diseases, married a healthy man. Determine the probable phenotypes of children from this marriage.

№7. In human, the gene that determines the flaw nail syndrome and the gene that determines blood group ABO, linked to each other and are located at a distance of 10 map units. The syndrome is inherited defect nail dominant type. One spouse is heterozygous for the defect nail syndrome and had an IV blood group. Second husband homozygous recessive genes in all and has an I blood group. Determine the probability of offspring phenotypes of this marriage.

Theme №13

Phenotypic and genotypic diversity

Diversity is a property of modified organisms under the influence of environmental factors, which is reflected in the acquisition of new and the loss of the old signs. There are two types of variability: phenotypic and genotypic.

Phenotypic (non-hereditary) diversity in phenotype provides change and can be developmental and modification. Ontogenetic variability manifests itself in the process of individual development. Modification diversity occurs under the influence of environmental factors. Examples of modifications in humans are tanning under the influence of UV-rays, change in body weight due to eating disorders. Modifications are of a certain character, have adaptive value, the degree of severity depends on the strength and duration of action of external factors, after the termination of the external factor, they usually disappear. The modifications are not inherited, but their range is genetically determined and inherited. Normal reaction can be narrow and wide. Examples of the wide norm of reaction in humans: weight, pigmentation of the skin. The narrow reaction norm: blood group systems ABO, Rh factor.

Genotypic (hereditary) diversity is associated with changes in the genotype. There are two types of genotypic diversity: combinative and mutational. When combinative diversity there are new combinations of genes appears. The main mechanisms of its occurrence are crossing over, the independent chromosome segregation in meiosis I, and random combination of gametes at fertilization. The biological significance of combinative diversity is to upgrade the genetic material, increasing the adaptive capacities of the organism and the variety of forms of the same species. Mutational diversity associated with a sudden change in the hereditary material. Mutations are classified according to the modified cells (generative and somatic), the nature of the changes in the genotype (gene, chromosome, interchromosomal, genomic, cytoplasmic), for a reason to call them (spontaneous and induced).

The objective: 1. To study the types and diversity characterization, modification, combinative and mutational variability, classification of mutations and their characteristics. 2. To solve problems on the combinative and mutational diversity. 3. To study statistical methods for studying the modification diversity.

Get ready to speak about:

1. Diversity, its types and forms.
2. Modification diversity. The rate of reaction. Statistical methods for studying the modification diversity.

3. Combinative diversity.
4. Mutational diversity. Classification of mutations.
5. Characteristics of the generative and somatic mutations.
6. Characteristics of the gene, chromosome, interchromosomal, cytoplasmic and genomic mutations.
7. Spontaneous mutations. The law of homologous series of genetic variation N.I. Vavilov.
8. Induced mutations. Physical, chemical and biological mutagens.
9. Genetics and the theory of diversity.
10. Meaning of genetics to medicine and health.

Basic concepts and terms

Diversity – property of organisms change under the influence of environmental factors as a result of new traits appear or loss of existing traits.

Modification – changing the phenotype under the influence of environmental factors without changing the genotype.

Norm of reaction – the limits of variability of traits controlled genotype.

Variation number – number of options, arranged in ascending order with an indication of the frequency of their occurrence.

Mutation – sudden abrupt qualitative change in the genotype, including changes in the structure of DNA, as well as changes in the structure or number of chromosomes.

Mutagens – physical, chemical or biological factors that can cause mutations.

Generative mutations – mutations occur in sex cells.

Somatic mutations – mutations occur in somatic cells.

Induced mutations – mutations that occur in the genotype in the direction of the impact on the body mutagens.

Spontaneous mutations – mutations that occur during normal conditions under the influence of environmental factors.

Check tests

1. Types of diversity: a) combinative; b) phenotypic; c) genotypic.

2. Types of phenotypic diversity: a) modification; b) mutation; c) ontogenetic.

3. Types of genotypic diversity: a) ontogenetic; b) combinative; c) mutation.

4. Diversity in which changes occurs phenotype without change the genotype: a) mutation; b) modification; c) combinative.

5. Properties of modifications:a) are not inherited; b) are defined and adaptive nature; c) it depends on the severity and duration of power factor.

6. Examples of narrow norm of reaction: a) blood group; b) body weight; c) eye color.

7. Examples of wide norm of reaction: a) blood; b) body weight; c) the pigmentation of the skin.

8. Mechanisms of combinative diversity:a) crossingover; b) an independent chromosome segregation in meiosis I; c) random combination of gametes at fertilization.

9. Properties of mutations:a) character is indefinite; b) does not disappear after the termination of the factor; c) are not inherited; d) are inherited.

10. Statements of the mutation theory of H. de Fries:a) mutations can be either needable and harmful; b) mutations occur suddenly; c) new forms are stable; d) mutations can occur repeatedly.

11. Types of mutations according mutated cells: a) spontaneous; b) somatic; c) the genome; d) generative.

12. Types of mutations to change the hereditary material:a) gene, chromosome, interchromosomal, genome; b) generative; c) cytoplasmic; d) spontaneous.

13. Gene mutationis:a) change in structure of DNA; b) changes in structure of chromosomes; c) change in number of chromosomes.

14. Chromosomal mutation is: a) change in structure of DNA; b) changes in structure of chromosomes; c) change in number of chromosomes.

15. Genomic mutationis: a) change in structure of DNA; b) changes in structure of chromosomes; c) change in number of chromosomes.

16. Cytoplasmic mutationis: a) a change in DNA structure of the nucleus; b) changes in structure of chromosomes; c) changes in structure of DNA of mitochondria or plastids.

17. Types of genomic mutations: a) translocation; b) polyploidy; c) heteroploidy.

18. Types of mutations by their appear: a) generative; b) spontaneous; c) induced; d) somatic.

19. Spontaneous mutation is: a) mutations in the sex cells; b) mutations occurring in vivo; c) mutations in somatic cells.

20. Types of mutagens:a) physical; b) chemical; c) cytological; d) biological.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreignlearners of preparatory division. – Vitebsk VSMU, 2016. – P. 50–57.

Practical activities

I. Fill in the table:

«Differences mutations from modifications»

Criteria	Modifications	Mutations
Character of the changes to the external factor		
Dependencies change from strength and duration of action of an external factor		
Meaning the body changes caused by external factors		
Save the changes after the termination of an external factor		
Possibility of inheritance changes arising under the influence external factor		

II. Solve the problem in combinative variability:

№1. Polydactyly is defined by an autosomal dominant gene. What is the probability of the disease in the family polydactyly of heterozygous parents? What is the probability of disease polydactyly in a family where one parent is heterozygous, and the other is normal on the basis of the analyzed?

№2. In humans, deaf-mutism is inherited as an autosomal recessive trait, and gout - as a dominant trait. Both genes are in different pairs of chromosomes. Determine the probability of the deaf child with a predisposition to gout have a deaf-mute mother, but does not suffer from gout, men with normal hearing and speech suffering from gout.

№4. Familial hypercholesterolemia is inherited dominantly through the autosomes. Identify possible degree of hypercholesterolemia in children in a

family where both parents are heterozygotes. Determine the probability of children born with an abnormality in a family where one parent is sick, and the other is normal with respect to the analyzed trait.

Theme №14

Fundamentals of genetics (summing-up class)

The objective: 1. Identify the degree of assimilation of knowledge by students of the basic laws of heredity and variation. 2. To solve the case studies in the mono- and dihybrid cross, to apply this knowledge to explain the process of inheritance of traits and sex determination.

Get ready to speak about:

1. Subject, tasks and methods of genetics.
2. Monohybrid cross. The law of uniformity of the first generation hybrids.
3. The law of splitting its cytological bases.
4. Dihybrid cross. Law of the independent inheritance and combining features of its cytological bases.
5. Genetics of sex.
6. The sex-linked inheritance.
7. Linked inheritance. Full and partial grip of genes in the chromosomes. Rule T. Morgan.
8. The chromosomal theory of heredity.
9. Interaction of single genes and different alleles.
10. Diversity, its types and forms. Modification diversity. The rate of reaction.
11. Combinative diversity.
12. Mutational diversity. Classification of mutations.
13. Gene, chromosomal, genomic, and cytoplasmic mutations, their characteristics.
14. Spontaneous and induced mutations. The law of homologous series of genetic variation N.I. Vavilov.
15. Genetics and the theory of diversity.
16. Meaning of genetics to medicine and health.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreignlearners of preparatory division. – Vitebsk VSMU, 2016. – P. 38–57.

Practical activities

I. Solve the problems in the mono- and dihybrid cross (by individual assignments).

Theme №15

Systematics of the organic world. Viruses. Bacteria. Fungi

The organic world of the Earth is characterized by huge variety of species. Modern taxonomy classifies certain groups of organisms on each other systematic superordinate categories – species, genera, families, orders (orders), classes, types (departments), subkingdoms, kingdoms and superkingdom. Each species has a scientific Latin name consisting of two words. The first word is the name of the genus, the second is the specific epithet. On Earth, there are non-cellular and cellular life forms. For non-cellular forms of life are viruses. Simple viruses consist of nucleic acid (DNA or RNA) and protein shell (capsid). Viruses cause serious diseases of plants (tomato mosaic disease, tobacco), animals (foot and mouth disease, swine) and human (influenza, measles, smallpox, rabies, Acquired Immune Deficiency Syndrome). Acquired Immune Deficiency Syndrome (AIDS) is caused by the human immunodeficiency virus (HIV). HIV has a protein shell and bilipidnyu, genetic information is stored in RNA. The main routes of HIV transmission are sexual contact, the use of non-sterile instruments, blood transfusions. The virus can be transmitted from mother to fetus during pregnancy, childbirth or lactation, as well as the transplantation of organs and tissues. AIDS prevention includes elimination casual sex, sterilization of medical instruments, the use of disposable syringes, monitoring donor blood, health education of the population.

The objective: 1. To study the taxonomy of the organic world, especially the structure and activity of viruses, bacteria and fungi. 2. To give classification of living organisms, to explain life processes of viruses, bacteria and fungi on the basis of their structure. 3. Be familiar with basic methods of transmission of HIV and AIDS prevention.

Get ready to speak about:

1. Fundamentals of taxonomy of the organic world. Basic taxonomic categories.
2. Acellular forms of life. Viruses. AIDS virus. AIDS prevention.
3. Bacteria. The structure and life of bacteria. The role of bacteria in nature and human life.
4. Features of prokaryotic and eukaryotic cells.
5. Fungi:
 - general characteristics and classification of fungi;
 - molds, yeasts;
 - shlyapochnye mushrooms, especially their structure and functioning;
 - fungi-parasites;
 - value of fungi in nature and human life.

Basic concepts and terms

Viruses – non-cellular life forms, consisting of nucleic acid (DNA or RNA) and a protein coat (capsid).

Bacteriophages – viruses of bacteria.

Prokaryotes – cellular life forms that do not have issued the nucleus.

Eukaryotes – organisms whose cells have a nucleus, as well as the obligatory intracellular structures - organelles.

Check tests

1. **Acellular life forms:** a) plants; b) bacteria; c) bacteriophages; d) viruses.
2. **Capsid is:** a) a nucleic acid of the virus; b) the resting stage of the virus; c) the protein coat of the virus.
3. **Virus consists of:** a) nucleus; b) DNA or RNA; c) capsid.
4. **Bacteriophages is:** a) plant viruses; b) bacteria; c) viruses of bacteria.
5. **Human diseases caused by viruses:** a) influenza; b) a plague; c) armature; d) cholera.
6. **Prokaryotes include:** a) plants; b) bacteria; c) mushrooms; d) viruses.
7. **Bacterial cells comprise:** a) a shell; b) the cytoplasm; c) nucleus.
8. **Ball bacteria:** a) cocci; b) bacilli; c) vibrios; d) spirillum.
9. **Rod-shaped bacteria:** a) cocci; b) bacilli; c) vibrios; d) spirillum.
10. **Curved bacteria:** a) cocci; b) bacilli; c) vibrios.
11. **What are organelles in cells of bacteria?** a) mitochondria; b) Golgi complex; c) the ribosome.

12. **Type of division in bacteria:** a) amitosis; b) mitosis; c) meiosis.
13. **The method of bacterial development:** a) conjugation; b) sporulation; c) the binary division.
14. **Types of bacteria by food:** a) autotrophic; b) aerobic; c) heterotrophic.
15. **Human diseases caused by bacteria:** a) influenza; b) a plague; c) tuberculosis; d) cholera.
16. **The body of fungi consists of:** a) tightly interwoven hyphae; b) the dispute; c) noncellular substance.
17. **The method of fungi division:** a) parts of the mycelium; b) sporulation; c) budding.
18. **Moulds:** a) mushroom; b) ergot; c) penicillium; d) mucor.
19. **Parts of pileate fungi:** a) fruiting body; b) the mycelium; c) root.
20. **Fungi-parasites:** a) mushroom; b) ergot; c) smut; d) mucor.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreignlearners of preparatory division. – Vitebsk VSMU, 2016. – P. 58–65.

Practical activities

I. Fill in the table:

"The importance of bacteria in nature and human activities"

Group of bacterias	Kind of food	Meaning in nature and value of human life
Putrid living on dead animals		
Purple		
Iron bacteria		
Lactic		
Nitrifying		
Pathogenic		

«Features of prokaryotes and eukaryotes»

Feature	Prokaryotes	Eukaryotes
Cytoplasmic membrane		
Nucleus		
Genetic apparatus		
Endoplasmic reticulum		

Ribosomes		
Mitochondria		
Golgi complex		
Cell center		
Lysosomes		
Vacuoles		
Flagella and cilia		

Theme №16

Botany is science about plants. Algae. Lichens

Botany is a science that studies the structure of plants, especially their ability to live, classification, distribution, relationship to the environmental conditions, the value of nature and human life.

Botany is a set of disciplines. Morphology studies the plant variety of external forms of plants; anatomy – fabrics and their location in various organs of plants; physiology – vital processes and peculiarities of metabolism in plants; taxonomy – the classification of the plant kingdom; ecology – the relationship of plants to environmental conditions; geobotany and plant geography – laws governing the formation of vegetation and distribution of plants in the world; paleobotany – fossil plants, their structure and systematics. For the classification of plants, the following systematic categories: species, genus, family, order, class, department, subkingdom.

The objective: 1. To study the features of the structure and activity of algae and lichens. 2. To give a description of algae, lichens classified. 3. To view the role of algae and lichens in nature and human life.

Get ready to speak about:

1. Botany. Classification of plants.
2. Algae. Structure and reproduction of unicellular and multicellular algae. The value of algae.
3. Lichens. The structure, nutrition, reproduction, lichen. The role of lichens in nature and human life.

Basic concepts and terms

Botany – science that studies the structure and characteristics of plant life.

Algae – lower plants living in predominantly aqueous medium.

Lichens – symbiotic organisms composed of algae and fungi (sometimes they settled azotobacter).

Zoospores –specialized cells that serves to asexual reproduction of algae and some fungi, can move in the water with the help of flagella.

Check tests

1. **Botany is:**a) science of plants; b) science of animals; c) science of cell.
2. **The lower plants include:**a)algae; b) ferns; c) gymnosperm; d) angiosperms.
3. **The higher plants include:** a) algae; b)ferns; c) gymnosperms; d) angiosperms.
4. **What are the categories used in the taxonomy of plants?**a)order; b) the family; c) detachment; d) kingdom.
5. **Unicellular algae:**a) chlamydomonas; b) chlorella; c) spirogyra; d) ulothrix.
6. **Multicellular algae:** a) chlamydomonas; b) chlorella; c) spirogyra; d) ulothrix.
7. **Organelles algae which contain chlorophyll:** a) chloroplasts; b) chromatophores; c) mitochondria.
8. **Type of algae food:**a) autotrophic; b) heterotrophic; c) mixotrophic.
9. **Method of algae reproduction:**a) dividing the thallus; b) sporulation; c) copulation; d) conjugation.
10. **Unicellular green algae include:**a) chlamydomonas; b) chlorella; c) ulothrix; d) spirogyra.
11. **Chlamydomonas asexual reproduction is carried out:** a) conjugation; b) without flagella disjuncts; c) zoospores.
12. **Asexual reproduction of chlorella is carried out:** a) conjugation; b) without flagella disjuncts; c) zoospores.
13. **Ulothrix is:** a) unicellular algae; b) lichen; c) filamentous multicellular algae.
14. **What are algae multiply zoospores:** a) chlamydomonas; b) chlorella; c) ulothrix.
15. **Conjugation going on:** a) chlamydomonas; b) spirogyra; c) ulothrix.
16. **Lichens are:** a) animals; b) a symbiosis of fungus and algae; c) plant.
17. **Body of lichensare:**a) the thallus; b) a single cell; c) mycelium.
18. **Shape of the lichens:**a) crustaceous; b) bushy; c) foliated; d) root.

19. **The method of lichens reproduction:**a) pieces of the thallus; b) sporulation; c) sexual reproduction.

20. **Representatives of the lichen:**a) parmeliya; b) spirogyra; c) moss.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreign learners of preparatory division. – Vitebsk VSMU, 2016. – P. 70–75.

Practical activities

I. Fill in the table:

"The importance of algae and lichens in nature"

Species	Habitat in the nature	Habitat in the nature and value of human life
Chlamydomonas		
Spirogyra		
Reindeer moss		

"The diversity of lichens in nature"

Group of lichen	Structure of the crustose thallus	Representatives
Crustose		
Foliose		
Bushy		

Theme №17

Higher plants. Vegetative and generative organs of plants

Flowering plants have vegetative organs, providing vital functions of the body and vegetative propagation, generative and serving for seed multiplication. By the vegetative organs are root, shoot, stem, leaf and modifications to the generative - flower, fruit, seed.

The root is underground vegetative body adapted to strengthen plants in soil suction of water and mineral salts. Furthermore, the root performs other

functions: stores nutrients entering symbiosis with nodule bacteria and fungi hyphae synthesizes nitrogen-containing organic compound (vitamins, hormones, certain amino acids), is used for plant micropropagation.

Stem is aboveground vegetative organ axis performing a support function, and conductive. The stem can store and perform protective functions involved in photosynthesis. It is the organ of vegetative propagation.

Sheet is aboveground vegetative organ adapted for photosynthesis, gas exchange and transpiration. Furthermore, the sheet can function as reserve nutrients and body micropropagation.

Stem with disposed thereon leaves and buds called escape. The flower is the organ of seed breeding and is a modified short shoots. Flowers provide for the formation of gametes and spores, as well as the development of seeds and fruits.

Seed is generative organ, which control the reproduction and dispersal of plants. The seed consists of an embryo, nutrient storage and the seed coat.

Fruit is generative organ of flowering plants, growing as a result of fertilization of the flower that provides maturation, protection and resettlement of seeds.

The objective: 1. To study the features of the structure and function of vegetative and generative organs of plants. 2. To give a classification of plants. 3. To view the modifications of roots, shoots and leaves.

Get ready to speak about:

1. Vegetative and generative organs of plants.
2. Root. Types of roots. Types of root systems. The functions of the root.
3. Stem, its value. The escape.
4. Sheet and its functions.
5. Flower, its structure. The structure of the stamens and pistil.
6. Seed. Fetus.

Basic concepts and terms

Vegetative organs – organs of plants, providing the vital processes of the body and vegetative propagation.

Generative organs – organs of plants, providing seed multiplication.

Flower – modified short shoots, which form spores and gametes occurs pollination, fertilization, seed and fruit development.

The seed – an embryo with a supply of nutrients enclosed in skin and develops from the ovule.

Fruit – generative organ of the plant, which consists of the pericarp and seed.

Check tests

1. **Vegetative organs of plants:**a) root; b) fruit; c) stem; d) sheet; e) seed.
2. **Generative organs of plants:**a) flower; b) fruit; c) stem; d) sheet; e) seed.
3. **Functions of root:**a) absorption of water and minerals; b) photosynthesis; c) the strengthening of the plants in the soil; d) is stored; e) the body of vegetative propagation.
4. **Functions of stem:**a) support; b) conducting; c) is stored; d) protection; e) photosynthesis.
5. **Functions of sheet:**a) photosynthesis; b) gas exchange; c) is stored; d) transpiration; e) body of vegetative propagation.
6. **Stem with leaves and buds is called:** a) tuber; b) escape; c) flower; d) root.
7. **Modified short shoots is:** a) sheet; b) seed; c) flower; d) root.
8. **Parts of the flower:**a) peduncle; b) receptacle; c) perianth; d) stamens and pistils.
9. **Perianth consists of:**a) halo; b) stamens; c) flower stalk; d) cup.
10. **Calyx consists of:** a) pestle; b) stamens; c) petals; d) sepals.
11. **Corolla is composed of:** a) pestle; b) stamens; c) petals; d) sepals.
12. **Parts of the stamens** a) bellow; b) ovary; c) staminal filament; d) column.
13. **Parts of the pistil:** a) bellow; b) ovary; c) stigma; d) column.
14. **From the flower:** a) escape; b) receptacle; c) kidney; d) fruit with seeds.
15. **Embryo with a supply of nutrients enclosed in the peel it is:** a) sheet; b) seed; c) flower; d) root.
16. **Seed is formed from:** a) stamens; b) ovule; c) wall of the ovary.
17. **Role of seed:** a) are involved in pollination; b) provide reproduction and dispersal of plants; c) participating in fertilization.
18. **Pericarp is formed from:**a) stamens; b) egg; c) ovules; d) wall of the ovary.
19. **Plant organ consisting of pericarp and seed:**a) fruit; b) seed; c) flower; d) root.

20. **Role of the fetus:** a) involved in pollination; b) involved in fertilization; c) ensure the protection and distribution of seeds.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreignlearners of preparatory division. – Vitebsk VSMU, 2016. – P. 75–94.

Practical activities

I. Fill in the table:

"Vegetative and generative organs of plants"

Organs	Functions
Vegetative organs: Root Stem Leaf	
generative organs: flower fruit seeds	

Theme №18

Higherplants.Mossy.Fern

Spread Moss family is the higher plants, the body of which is differentiated into stem and leaves. The function of the roots is performing rhizoids. Spread Moss family is relatively simple internal organization. In a series of mossy gametophyte sporophyte dominates. Sporophytes not develop as an independent plant. It is associated with gametophyte morphologically and physiologically. Spread Moss family is found on all continents of the globe, often in places with adequate or excessive moisture.

Fern is higher spore plants. They live in damp dark forests, ravines, boggy meadows. Most of fern is terrestrial plants. However, there are aquatic forms. For ferns was characterized by the presence of the stem, leaves and roots. The life cycle is dominated by asexual generation (sporophyte). The sexual generation (gametophyte) lives alone. Fern fertilization is possible only if the aquatic environment.

The objective: 1. To study the features of the structure and functioning and mossy fern. 2. To allocate the sporophyte and gametophyte stage in the life cycles of mosses and ferns. 3. Read the diversity of species and mossy fern, their role in nature and human life.

Get ready to speak about:

1. Spread Moss family. Structure and life cycle of the moss Kukushkin flax.
2. The role of bryophytes in human life.
3. Ferny. Structure and development cycle of Dryopteris male.
4. The value of fern to human.

Basic concepts and terms

Gametophyte – sexual generation in the life cycle of plants, in which gametes are formed. It has a haploid set of chromosomes.

Sporophyte – asexual generation in the life cycle of plants, in which spores are formed; it has a diploid set of chromosomes.

Sporangia – organs of asexual reproduction in which the spores are formed.

Antheridia – bodies of sexual reproduction spore plants (algae, mosses, ferns) and fungi that produce sperm.

Archegonia – bodies of sexual reproduction in mosses, club mosses, horsetails, ferns and gymnosperms, which are formed egg.

Check tests

1. **Vegetative organs of bryophytes:** a) list; b) stem; c) root.
2. **What is asexual generation in plants:** a) sporophyte; b) gametophyte; c) antheridium.
3. **What is sexual generation in plants:** a) sporophyte; b) gametophyte; c) sporogony.
4. **What is formed in antheridia:** a) ovums; b) sperm; c) disputes.
5. **What is produced in archegonia:** a) ovums; b) sperm; c) disputes.
6. **Mosses are:** a) lower plants; b) higher spore plants; c) seed plants.
7. **Where are the sporophyte and gametophyte mosses?** a) in the same plant; b) on different plants; c) on prothallia.
8. **What grows from spores of moss?** a) box on the leg; b) zarostok; c) sporophyte.

9. **What is the zygote is formed from moss Kukushkin flax?** a) gametophyte; b) zarostok; c) sporogony.
10. **Life cycle of mosses is dominated by:** a) the sporophyte; b) gametophyte; c) sporangium; d) gametangium.
11. **Sporogony from moss it is:**a) the sporophyte; b) gametophyte; c) archeonium; d) antheridium.
12. **From the kidney of protonema moss grows:** a) the dispute; b) sporophyte; c) gametophyte.
13. **Vegetative organs of fern:**a) list; b)stem; c) root.
14. **What grows from spores of ferns?**a) box on the leg; b) zarostok; c) sporophyte.
15. **Where are the fern sporangia have?**a)on the leaves; b) on the rhizome; c) on the stem; d) on prothallia.
16. **Fern grows from a zygote?** a) zarostok; b) gametophyte; c) sporophyte.
17. **Prothallia from fern:**a) antheridia; b) archeonia; c) disputes.
18. **Fern life cycle prevails:** a) gametophyte; b) antheridium; c) sporophyte; d) archeonium.
19. **From zygote fern develops:**a) an embryo; b) the dispute; c) gametangia; d) sporangia.
20. **Zarostok from fern fed:**a) on their own; b) at the expense of the gametophyte; c) by the sporophyte.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreign learners of preparatory division. – Vitebsk VSMU, 2016. – P. 94–98.

Practical activities

I. Fill in the table:

"Comparative characteristics and mossy fern"

Order	Vegetative organs	Generative organs	Sporophyte	Gametophyte
Spread Moss family				
Ferny				

Theme №19

Higher plants. Gymnosperms. Angiosperms

Gymnosperms are the higher seed plants. It is heterosporous plants. Microspores (pollen) ripen in microsporangiums located in the male cones and makrospory in makrosporangyovules located in the female cones. Male gametes (sperm) are fixed, they are delivered to the egg via pollen tube during germination of pollen. Thus, in gymnosperms fertilization process does not depend on the presence of water. A characteristic feature is the presence of a seed of gymnosperms. Seed other than multicultural embryo, has the supply of nutrients required for its growth.

There are about 800 species of gymnosperms, which are in the temperate regions of the globe. All of them are woody plants and shrubs are well developed stem, strong root system, consist from the main, lateral and adventitious roots, leaves in the form of needles.

Angiosperms are the most numerous group of plants. They occur in all climatic zones, on all continents, occupying a dominant position on the ground. For a typical angiosperm flower availability of which is adapted to reproduce. There are processes of spore formation, the formation of gametophytes, gametes and fertilization, and seed formation, the prisoners inside the fruit. Unlike the gymnosperms ovules (ovules) in angiosperms are enclosed in a closed cavity of the ovary, so no pollen falls on pyltsevhod, and stigma. For angiosperms was characterized by further reduction of gametophytes. They have not formed antheridia and archegonia. One of the characteristic features of angiosperms - double fertilization in which one sperm cell fuses with a haploid egg to form a zygote, and the other - with diploid central cell, forming a triploid endosperm.

The objective: 1. To study the features of the structure and functioning of gymnosperms and angiosperms. 2. To allocate the sporophyte and gametophyte stage in the life cycles of gymnosperms and angiosperms. 3. Read the diversity of species of gymnosperms and angiosperms, their role in nature and human life.

Get ready to speak about:

1. Division Gymnosperms. The structure of Scots pine.
2. Life cycle of Scots pine.
3. Department of angiosperms. Features of the life cycle of angiosperms.

4. Comparative characteristics of monocots and dicots.

Basic concepts and terms

Microsporangium – organ of asexual reproduction in which microspores are formed.

Megasporangii – organ of asexual reproduction, which are formed megaspores (makrospory).

Nucellus – fabric ovule (ovules), from which formed megaspores (makrospory).

Endosperm – fabric with a margin of substances necessary for the development of the embryo plant.

Monocots – angiosperms, whose embryo has one cotyledon (wheat).

Dicotyledonous plants – angiosperms, whose embryo has two cotyledons (beans).

Check tests

1. **Gymnospermsis:** a) lower plants; b) higher spore plants; c) seed plants.

2. **Male pine cones are:** a) archegonia; b) microsporangia; c) megasporangii.

3. **What forms of microspores pine?** a) female gametes; b) pollen; c) zygote; d) megaspores.

4. **What forms of dust in gymnosperms?** a) egg; b) sperm; c) pollen tube; d) dispute.

5. **Where pine ovules are located:** a) in female cones; b) in male cones; c) in zygote.

6. **What forms of megaspores pine?** a) female gametophyte; b) male gametophyte; c) zygote; d) pollen.

7. **Male gametophyte pine is:** a) zarostok archegonia; b) speck of dust; c) seed; d) zygote.

8. **Female gametophyte pine is:** a) zarostok archegonia; b) speck of dust; c) seed; d) zygote.

9. **What is involved in sperm fertilization of pine?** a) 1; b) 2; c) 3.

10. **What forms of fabric female prothallia after fertilization of pine?** a) embryo; b) pollen; c) endosperm.

11. **Which set of chromosomes is from the endosperm of gymnosperms?** a) haploid; b) diploid; c) triploid; d) polyploid.

12. **Where do angiosperm ovules are:** a) in the anthers; b) in the ovary of the pistil; c) in the fruit.

13. **Where microspores formed in flowering plants?**a)in the anthers; b) in the ovary of the pistil; c) in the fruit.
14. **How many "cells" in the embryo sac in the angiosperms?**a) 1; b) 2; c) 4; **d) 8.**
15. **What is involved in sperm fertilization in angiosperms?**a) 1; b) 2; c) 3.
16. **Which set of chromosomes is the endosperm in flowering plants?** a) haploid; b) diploid; c) threeploid; d) polyploid.
17. **Which set of chromosomes is the embryo in flowering plants?** a) haploid; **b) diploid;** c) triploid; d) polyploid.
18. **In which there is a double fertilization of plants?** a) fern; b) gymnosperms; **c) angiosperms.**
19. **The pericarp is formed from:** a) the endosperm; b) the zygote; c) pollen; **d) the wall of the ovary.**
20. **Generative organs of angiosperms:**a) flower; b) list; c) seed; **d) fruit.**

Literature

Bekish V.J., Zoryna V.V. Biology: for foreignlearners of preparatory division. – Vitebsk VSMU, 2016. – P. 98–102.

Practical activities

I. Fill in the table:

"Comparative characteristics of monocots and dicots"

Signs	Class Monocotyledonous	Class Dicotyledones
Type of root system		
Cotyledon leaves		
Number in the bud Location		
Bundles in the stem		
Tissue educational presence in bunches		
The number of parts of the flower		

Theme №20

Viruses.Bacteria.Mushrooms.Plants (summing-up class)

The objective: 1. To identify the degree of assimilation of knowledge on the specifics of the structure and activity of viruses, bacteria, fungi and plants.
2. To give a classification of living organisms, to explain life processes of viruses, bacteria, fungi and plants, on the basis of their structure.

Get ready to speak about:

1. Fundamentals of taxonomy of the organic world. Basic taxonomic categories.
2. Viruses. Bacteriophages, their structure and role.
3. Bacteria, their structure and role.
4. Mushrooms. General characteristics and classification of fungi.
5. Moulds. Yeasts. Pileate mushrooms. Mushrooms parasites.
6. Botany is the study of plants. Classification of plants.
7. Vegetative plant organs: root, stem, leaves, shoots.
8. Generative organs of plants. The structure of the flower, seed, fruit.
9. Algae. Structure and reproduction of unicellular and multicellular algae. The value of algae.
10. Lichens. The structure, nutrition, reproduction, lichen. The role of lichens in nature and human life.
11. Mosses. Structure and reproduction of moss Kukushkin flax as an example.
12. Ferns. Structure and reproduction of ferns.
13. Gymnosperms. Structure and reproduction of gymnosperms (for example, Scots pine).
14. Angiosperms characteristics of their life cycle.
15. Comparative characteristics of monocots and dicots.

Literature.

Bekish V.J., Zoryna V.V. Biology: for foreign learners of preparatory division. – Vitebsk VSMU, 2016. – P. 58–102.

Practical activities

I. These systematic position of the representatives of viruses, bacteria, fungi and plants (for individual assignments)

Theme №21

Zoology is science about animals. Monocellular animals

Zoology is a science that studies the structure and livelihoods of animals, their diversity and distribution, relationship with the environment, patterns of individual and historical development. The subject of zoology is monocellular and multicellular animals.

The following categories are used for the systematic classification of animals: species, genus, family, order, class, type, subkingdom.

The body of monocellular animals is represented by a single cell, which functions as a body. The bodies of the movement they serve pseudopodia, flagella or cilia. Digestion of animals is carried out either by ingestion of solid organic particles through the cell by special throat (ciliates) or osmotic (whole body surface). Gas exchange and the allocation is carried throughout the body surface. Irritability of unicellular manifested in the form of taxis. Reproduction can go by asexual or sexual way. In some species, there is an alternation of sexual and asexual reproduction. Under adverse conditions, most species forms cysts. For monocellular animals include representatives such as Sarcomastigophora, type Apicomplexa and the type of Infusoria. The type Sarcomastigophora includes Zoomastigota classes (flagellates) and Sarcodina.

Type Apicomplexa includes Sporozoa class (Spore). By Infusoria type refers Ciliata class (ciliates).

The objective: 1. To study the features of the structure and functioning of single-celled animals. 2. To be able to give Sarcomastigophora type characteristic (Sarcodina classes, Zoomastigota), type Apicomplexa (Sporozoa class) and the type of Infusoria (Ciliata class) by the example of their representatives. 3. Read the medical value of single-celled animals.

Get ready to speak about:

1. Zoology as a science. The value of animal nature and human life.
2. General characteristics and classification of monocellular animals.
3. The characteristics of Sarcodina class. Features of the structure and functioning of common amoeba. Medical value of rhizopods.
4. The characteristics of the class Zoomastigota. Features of the structure and functioning of green Euglena. Medical value of flagellate.
5. The characteristics of the type of Infusoria. Class Ciliata: features of the structure and functioning ciliate-shoes. Medical value of ciliates.
6. The characteristics of the type of Apicomplexa. Class Sporozoa: features of the structure and functioning of the malaria plasmodium. Medical value Sporozoa.

Basic concepts and terms

Sarcodina – monocellular animals with unstable body shape, have organs of locomotion - pseudopodia (amoeba).

Flagellates – monocellular animals, organs of movement which are flagella (euglena, leishmania, trypanosome).

Spore – monocellular animal parasites, whose lifecycle has sporozoite stage (malaria plasmodium).

Ciliates – monocellular animals, organs of movement which are cilia (ciliate-shoe, balantidiums).

Check tests

1. **Zoology is:** a) study of fungi; b) study of bacteria; c) study of plants; d) study of animals.

2. **Irregular shape of the body has:** a) amoeba; b) ciliate-slipper; c) euglena green.

3. **Response to stimulation of the unicellular:** a) reflex; b) tropism; c) taxis.

4. **Under environmental conditions, monocellular animals forms:** a) gametes; b) cysts; c) disputes.

5. **Mixotrophic type of food is typical for:** a) Plasmodium falciparum; b) Amoeba Proteus; c) ciliate-shoes; d) Euglena green.

6. **Representative of Sarcodina:** a) amoeba; b) ciliate-slipper; c) euglena green; d) trypanosome.

7. **Motion of bodies in an amoeba:** a) false foot (pseudopodia); b) flagella; c) cilia; d) no.

8. **Amoeba multiplies by:** a) dividing in half the body; b) disputes; c) cysts; d) sexually.

9. **Representatives of the flagellates:** a) an amoeba; b) ciliate-slipper; c) euglena green; d) trypanosome.

10. **Motion bodies in Euglena green:** a) flagella; b) false foot; c) cilia; d) no.

11. **Number of cores in Euglena green:** a) 1; b) 2; c) 4.

12. **Motion Bodies of ciliate-shoes:** a) false foot; b) flagella; c) cilia.

13. **Number of nuclei in ciliate-shoes:** a) 1; b) 2; c) 4.

14. **Method of reproduction ciliate-shoes:** a) binary fission; b) sporulation; c) conjugation.

15. **Cellular mouth and pharynx are in:** a) Amoeba proteus; b) ciliate-shoes; c) Euglena green; d) malaria plasmodium.

16. **Method of reproduction of the malaria parasite:**a) copulation; b) sporulation; c) schizogony; d) conjugation.

17. **Final host for malaria plazmodium:**a) mosquito; b) person; c) dog.

18. **Intermediate host for malaria plazmodium:** a) mosquito; b) person; c) dog.

19. **Motion bodies in malaria plazmodium:** a) flagella; b) false foot; c) the cilia; d) no.

20. **Single-celled, human pathogens:** a) Amoeba proteus; b) lamblia; c) malaria plazmodium; d) balantidium.

Literature.

Bekish V.J., Zoryna V.V. Biology: for foreignlearners of preparatory division. – Vitebsk VSMU, 2016. – P. 103–112.

Practical activities

I. Fill in the table:

"Comparative characteristics of monocellular animals"

Signs	Class Sarcodina	Class Zoomastigota	Class Ciliata	Class Sporozoa
Typical representative				
Shape of the body				
Motion of organelles				
Nuclear device				
Way of digestion				
Organs of digestive system				
Excretory organs				
Response to the action of the stimulus				
Reproduction				
Transfer of adverse conditions				

Theme №22

Type Coelenterates.Type Flatworms

Coelenterata type (Coelenterates) is lower multicellular animals living in the sea and fresh water. They are characterized by radial symmetry of the body. The wall of the body is formed by two layers of cells: ektoderm and endoderm, which is located between mesoglea. The body's cells are differentiated depending on the function. In coelenterates the first appears nervous system of the diffuse type. Sacciform body, with one mouth opening leading into the intestinal lumen, where under the influence of enzymes occurs digest food. Small food particles are trapped and digested intracellularly by endoderm cells. Breathing is carried throughout the body surface. Coelenterates multiply both asexually and sexually. Among them there are also dioecious animals, and hermaphrodites. Many coelenterates there is a change of asexual and sexual generations. Asexual deneration are attached to the bottom of polyps sex – free-jellyfish. Some species only exist in a polyp or a jellyfish. Coelenterates capable of regeneration.

Plathelminthes type (flat worms) is three-layer, bilaterally symmetrical animals. Representatives types have leaf-shaped or flat ribbonlike body fixation organs (suckers hooks). The wall of the body is formed of skin-muscular bag. The body cavity is no space between the organs filled with parenchyma. The digestive system is represented by front and midgut, which ends blindly. The undigested food debris ejected through the mouth. The excretory system protonefridiale type. They do not have respiratory system. Breathing in free flatworm carried across the body surface. The nervous system is ladder, presented by peripharyngeal nodes peripharyngeal ring and radiating nerve trunks. Most flatworms are hermaphrodites. Reproduction (copulation and parthenogenesis) in ciliated – asexual (fragmentation). Plathelminthes type includes Turbellaria classes (turbellarians), Trematoda (Flukes), Cestoidea (tapeworms).

The objective: 1. To study the features of the structure and functioning of coelenterates and flatworms. 2. To give a description of the type and Coelenterata Plathelminthes type on the example of their representatives. 3. Read the medical value of coelenterates and flatworms.

Get ready to speak about:

1. General characteristics of the type Coelenterata.
2. Class Hydrozoa. Structure and livelihoods of Hydra.
3. The variety of coelenterates, their importance in nature and human life.
4. General characteristics of the type Plathelminthes.

5. Class Trematoda. The structure and life cycle of the liver fluke. Medical value of flukes.

6. Class Cestoidea. The structure and life cycle of the bovine tapeworm. Medical value of tapeworms.

Basic concepts and terms

Coelenterates – lower double-layer multicellular animals.

Flat worms – lower three layers bilaterally symmetrical animals have a flat body, the body cavity is absent.

Flukes –representatives flatworms have leaf-shaped, fixing bodies - sucker (eg, liver fluke).

Tapeworms – representatives of flatworms are ribbon-like shape of the body; body consists of a head, neck and segments (eg, bovine tapeworm).

Protonephridia – organ allocation and osmoregulation flat and round worms. They consist of cells with a bundle of cilia, which departs from the tubule. Several tubular flow into the main channel, which opens out sometimes.

Check tests

1. Body of coelenterates consists of: a) single layer of cells; **b)** two layers of cells; c) three layers of cells.

2. Ectoderm cells are:a) nerve; **b)** stinging; **c)** intermediate; **d)** gland; **e)** epithelial-muscle.

3. Endoderm cells: a) nerve; **b)** stinging; **c)** intermediate; **d)** gland; **d)** epithelial-muscle.

4.Symmetry of hydra body: a) bilateral; **b)** radial; **c)** is absence.

5.Nervous system in hydra is:a) diffuse type; **b)** node type;**c)** the ladder; **d)** offline.

6.Regeneration is: a) type of asexual reproduction; **b)** type of food; **c)** restoration of the damaged parts of the body; **d)** type of sexual reproduction.

7. Irritability in hydra takes the form of: a) taxis; **b)** reflex; **c)** tropism.

8.Digestion in Coelenterates:a) intra-cavity; **b)** intracellular; **c)** diffuse.

9.Cells of coelenterates which provide regeneration: a) nerve; **b)** stinging; **c)** intermediate; **d)** gland; **e)** epithelial-muscle.

10.Representatives of coelenterates: a) ciliate-slipper; **b)** freshwater hydra; **c)**jellyfish; **d)** bovine tapeworm.

11.Body of flatworms consists of: a) single layer of cells; **b)** two layers of cells; **c)** three layers of cells.

12. Body symmetry in flatworms:a) bilateral; **b)** radial; **c)** is absence.

13. **Nervous system in flatworms:** a) diffuse type; b) node type; c) the ladder; d) offline.

14. **Parts of digestive system in flatworms:** a) front; b) average; c) back.

15. **Body cavity in flatworms is:** a) primary; b) secondary; c) is absence.

16. **Excretory organs in flatworms:** a) protonephridia; b) metanephridia; c) kidney; d) no.

17. **Final host for liver fluke:** a) man; b) cattle; c) clam.

18. **Intermediate host for liver fluke:** a) man; b) cattle; c) clam.

19. **Final host for bovine tapeworm:** a) man; b) cattle; c) clam.

20. **Intermediate host for the tapeworm bull:** a) man; b) cattle; c) clam.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreign learners of preparatory division. – Vitebsk VSMU, 2016. – P. 112–119.

Practical activities

I. Fill in the table:

"Comparative characteristics of flatworms»

Signs	Class Trematoda	Class Cestoidea
Typical representative		
Body symmetry(form)		
Symmetry		
Fixing organs		
Covers body		
Digestive system		
Excretory system		
Nervous system, system senses		
Reproductive system		
Reproduction		

Theme №23

Type Roundworms

By Nematelminthes type (round worms) refers Nematoda class (Actually roundworms). This is three-layer, bilaterally symmetrical animals. Cylindrical body, sharpened at the ends, in a cross section has a circular shape is for typical

of roundworms. The wall of the body is formed by the cuticle, epidermis and muscle layer. Primary body cavity has no epithelial lining, filled with internal organs and abdominal fluid. The digestive system is represented by front, middle and posterior intestine, ending anus. Representatives do not have respiratory system. The excretory system is by protonefridial type. The nervous system is presented above and subesophageal nodes peripharyngeal nerve ring and radiating nerve trunks. Roundworms are dioecious organisms. The reproductive system in females is paired, males have unpaired. Female reproductive system is represented by the ovaries, oviducts, uterus, vagina. Male reproductive system consists of testes, vas deferens, ejaculatory duct and copulatory organ. In roundworms pronounced sexual dimorphism (females are larger in size, males rear end is screwed). Reproduction is sexual (copulation).

The objective: 1. To study the features of the structure and functioning of roundworms. 2. To give a description of the type Nematelminthes the example of their representatives. 3. Read the medical value of roundworms.

Get ready to speak about:

1. General characteristics of the type Nematelminthes.
2. Class Nematoda. The structure and life cycle of the human roundworm.
3. The medical value of roundworms.
4. A variety of parasitic worms. Adaptation to parasitism.
5. Measures of prevention of infection and control of parasitic worms.

Basic concepts and terms

Roundworms – lower three layers bilaterally symmetrical animals having primary body cavity.

Primary body cavity – body cavity has no own epithelial lining.

Sexual dimorphism – anatomical difference between males and females of the same species, not counting the genitals.

Check tests

1. Body of roundworms in cross sections is: a) round; b) oval, divided into segments; b) rectangular.

2. Symmetry of the body from roundworms is: a) bilateral; b) radial; c) is missing.

3. Skin-muscular sac roundworms consists of: a) cuticle; b) hypodermis; c) longitudinal muscle.

- 4.Roundworms have body cavity:** a) primary; b) secondary; c) is absent.
- 5. Parts of intestine roundworms:** a) front; b)average; c) back.
- 6. Respiratory organs in roundworm are:** a) light; b) gills; c) absent.
- 7.Excretory organs of roundworms:** a) protonephridia; b) metanephridia; c) kidney; d) no.
- 8.The circulatory system in nematodes:** a) closed; b) non-closed; c) is absent.
- 9. Nervous system of roundworms consists of:**a) peripharyngeal nerve ring; b) the ventral nerve cord; c) above and subesophageal nodes; d) nerve trunks.
- 10. Roundworms are:** a) hermaphrodites; b) dioecious animals.
- 11. Representatives of roundworms:**a) ascaris; b) bovine tapeworm; c) liver fluke; d) pinworm.
- 12. Representatives of flukes:** a) ascaris; b) bovine tapeworm; c) liver fluke; d) pinworm.
- 13.Representatives of tapeworms:** a) ascaris; b) bovine tapeworm; c) echinococcus; d) pinworm.
- 14. Finn is:** a) bovine of tapeworm larva; b) roundworm larva; c) the adult pinworms.
- 15.Attachment organs of tapeworms:** a) sucker; b) hooks; c) absent.
- 16.Attachment organs of liver fluke:** a) sucker; b) hooks; c) absent.
- 17.. Attachment organs of roundworm:** a) sucker; b) hooks; c) absent.
- 18. Adaptations to parasitism in tapeworms:**a) the availability of organs of fixation; b) thick body coverings; c) high fertility; d) reduction of the digestive system.
- 19. The body consists of segments in:** a) roundworm; b) bovine tapeworm; c) echinococcus; d) pinworms; e) pork tapeworm.
- 20. Ascaris parasites in:** a)intestines; b) skin; c) lower limbs.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreignlearners of preparatory division. – Vitebsk VSMU, 2016. – P. 119–122.

Practical activities

I. Fill in the table:

"The characteristics of roundworms"

Signs	Class Nematoda
Typical representative	
Form of body	
Fixation	
Covers of body	
The body cavity	
Digestive system	
Excretory system	
Nervous system,senses	
Reproductive system	

Theme №24

Type Annelids.Type Mollusks

Annelida type (Annelida) – three-layer, bilaterally symmetrical animals, which are characterized by homonomous body segmentation. In annelids have a skin-muscular sac, the body is divided into head, torso and anal lobe. For the first time there is a secondary body cavity. The digestive system is a front, middle and rear sections of the intestine. Front part includes the mouth, pharynx, esophagus, stomach, and gaster. Ringed worms breathe through gills, and in their absence - the entire surface of the body. Authorities release by metanefridial type. In most species, there is a closed circulatory system. Nervous system consists of a pair above and subesophageal ganglia associated with peripharyngeal nervous ring and ventral nerve cord. Among annelids are found both animals are dioecious and hermaphrodite. Asexual reproduction (fragmentation) and sex (copulation). Ringed worms are capable of regenerating.

Mollusks type (shellfish) consists mainly of aquatic animals. The body of the mollusks unsegmented, bilaterally symmetrical or asymmetrical, consists of a head, torso and legs. There skinfold - mantle. The dorsal side of the body is covered with a sink. Secondary cavity of body in most species represented by the pericardial sac and a section about the sexual glands. The digestive system begins shellfish by mouth opening, followed by the pharynx, the esophagus, the stomach, the middle and hindgut. The intestine of a number of shellfish permeates the pericardial cavity. There are salivary glands and liver. The organs of respiration of aquatic molluscs are the gills, ground - light.

Authorities release is kidney by metanefridial type. Shellfish have not closed circulatory system. Their heart is consisting of atrial and ventricular parts. Nervous system node type 3 or 5 ganglia, interconnected nerve trunks. Among mollusks found both dioecious and hermaphrodite individuals. Reproduction is by copulation way.

The objective: 1. To study the features of the structure and functioning annelid worms and molluscs. 2. To give a description of the type of Annelida and Mollusca such as the example of their representatives. 3. Read the medical value of annelid worms and molluscs.

Get ready to speak about:

1. Annelida type. General characteristics of the type.
2. Class Oligochaetes. Structure and livelihoods of the earthworm.
3. Variety of worms and their role in nature.
4. Type Mollusca. General characteristics.
5. Class Snails. Features of the structure and functioning of an ordinary pond snail.
6. Variety of molluscs, their role in nature and human life.

Basic concepts and terms

Homonomous segmentation – segments of the body have the same structure and the same function.

Metanephridia – paired excretory organs in annelids. They represent the funnel opening in general. From the funnel leaves the channel through to the next segment and opens outward opening (excretory sometimes).

Secondary body cavity – space between the wall of the body and internal organs having own epithelial lining.

Check tests

1. **Symmetry in annelids is:** a) bilateral; b) radial; c) is absent.
2. **Body cavity in annelids is:** a) primary; b) secondary; c) is absent.
3. **Segmentation of the body in annelids is:** a) homonomous; b) heteronomous; c) is absent.
4. **Goiter - an enhanced part of:** a) stomach; b) throat; c) esophagus.
5. **Excretory organs in annelids:** a) protonephridia; b) metanephridia; c) kidney; d) no.

6. Nervous system in annelids consists of: a) three ganglia are connected with each other; b) three nerve trunks; c) ventral nerve cord; **d) peripharyngeal nerve ring.**

7. Respiratory system of earthworm is: a) light; b) gills; c) is absent.

8. Circulatory system of earthworm is: a) closed; b) non-closed; c) is missing.

9. Methods of propagation of worms: a) fragmentation; b) budding; c) simple division; **d) copulation.**

10. Representatives of annelids: a) ordinary trunquatula; **b) the earthworm;** c) a leech; d) bovine tapeworm.

11. Parts of the mollusks body: a) head; **b) trunk;** c) leg; d) cervix.

12. Body segmentation in molluscs: a) homonomous; b) heteronomous; c) is absent.

13. Digestive gland of mollusks: a) pancreas; **b) salivary glands;** c) liver.

14. Respiratory organs of mollusks: a) lungs; **b) gills;** c) are absent.

15. Excretory organs of shellfish: a) protonephridia; **b) metanefridial;** c) is absent.

16. Circulatory system in mollusks: a) closed; **b) non-closed;** c) is absent.

17. Nervous system of molluscs: a) diffuse type; **b) node type;** c) ladder; d) offline.

18. Method of reproduction in molluscs: a) fragmentation; b) budding; c) simple division; **d) copulation.**

19. Skin folds surrounding the trunk of molluscs: a) sink; **b) mantle;** generally.

20. Representatives of shellfish: a) ordinary trunquatula; b) earthworm; c) bezzubka; d) bovine tapeworm.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreign learners of preparatory division. – Vitebsk VSMU, 2016. – P. 122–129.

Practical activities

I. Fill in the table:

"Comparative characteristics of annelids and mollusks"

Signs	Type Annelida	Type Mollusca
Typical representative		
Body shape		
Segmentation		
Covers of the body		
Cavity of the body		
Digestive system		
Respiratory system		
Excretory system		
Circulatory system		
Nervous system, sense organs		
Reproductive system		
Reproduction		

Theme №25

Type Arthropods

Arthropoda (Arthropods) type has over 1.5 million species. For representatives of Arthropoda type characteristic heteronomous body segmentation. Body segments are combined into sections: head, thorax and abdomen. In crustaceans and arachnids only two parts – cephalothorax and abdomen. In arthropods are jointed limbs, chitin cover, appears striated muscles. The body cavity is mixed (mixocoel). The digestive system is represented by the front (pharynx, esophagus, crop, stomach), middle and posterior intestine. Mouth surrounded by mouthparts, are digestive glands – salivary gland and liver outgrowth. Respiratory system in aquatic arthropods is represented by gills, terrestrial – trachea and lungs. The excretory system is modified metanephridia, Malpighian vessels and fat body. The circulatory system of an open type, on the dorsal side has a heart. The nervous system is represented by the supra-oesophageal ganglion, peripharyngeal ring and ventral nerve cord, where there is a merger of the nerve ganglia. For the first time there is the endocrine system. It is represented by an accumulation of cells that produce the hormone ecdysone, which regulates the process of molting. Arthropods are dioecious animals, with well-marked sexual dimorphism. In female reproductive system is paired, in males - unpaired. Reproduction is mainly sexual.

Phylum Arthropoda includes three classes: Crustacea (Crustaceans), Arachnoidea (Arachnids) and Insecta (Insects).

The objective: 1. To study the features of the structure and functioning of crustaceans, arachnids and insects. 2. To give a description of phylum Arthropoda, as classes Crustacea, Arachnoidea Insecta and the example of their representatives. 3. Read the medical value of arthropods.

Get ready to speak about:

1. General characteristics of the type of Arthropoda.
2. Class Crustacea. Features of the structure and functioning of the crayfish.
3. Class Arachnoidea. Features of the structure and functioning spider Araneus.
4. Pliers, their medical importance.
5. Class Insecta. General characteristics of the class. The role of insects in nature and human life.

Basic concepts and terms

Heteronomous segmentation – segments of the body have different structure and different functions.

Malpighia vessels – excretory organs of arthropods, are outgrowths on the border of the middle and posterior intestine.

Mixocel – mixed body cavity (along with the remnants of the primary body cavity, there are the beginnings of the secondary).

Molting – change of chitin cover, controlled by a hormone ektizonom.

Check tests

1. **Body segmentation in arthropods:** a) homonomous; b) heteronomous; c) is absent.

2. **Body cavity in arthropods:** a) primary; b) secondary; c) mixocel; d) offline.

3. **Movement organs in arthropods:** a) flagella; b) jointed limbs; c) bristles; d) offline.

4. **The substance which is part of the integument of arthropods:** a) chitin; b) insulin; c) glucose.

5. **Representatives of Arthropods are:**a) the crayfish; b) the earthworm; c) spiders; d) mosquito.

6. **Parts of the crayfish body:** a) head; b) breast; c) cephalothorax; d) the abdomen.

7. **Respiratory organ in crayfish:** a) light; b) the gills; c) the trachea; d) no.

8. **Excretory organs in crayfish:** a) protonephridia; b) modified metanephridia; c) kidney; d) no.

9. **Circulatory system in crayfish:** a) closed; b) non-closed; c) is absent.

10. **Nervous system of a crayfish consists of:** a) peripharyngeal nerve ring; b) ventral nerve cord; c) above and subesophageal nodes; d) three nerve trunks.

11. **Respiratory organs of arachnids are:**a) light; b) gills; c) trachea; d) no.

12. **Type of reproduction in spider Araneus:** a) direct; b) nondirect with a complete metamorphosis; c) nondirect with an incomplete metamorphosis.

13. **Segmentation of the ticks body:** a) homonomous; b) heteronomous; c) is absent.

14. **Parts of insects body:** a) head; b) thorax; c) cephalothorax; d) abdomen.

15. **Excretory organs in insects:** a) protonephridia; b) Malpighian vessels; c) the fat body; d) no.

16. **Insects are:** a) hermaphrodites; b) dioecious animals.

17. **Respiratory system in insects:** a) light; b) gills; c) trachea; d) no.

18. **Sections of the intestinal tubes in insects:**a) front; b) average; c) back.

19. **Circulatory system of insects:** a) closed; b) non-closed; c) is absent.

20. **Representatives of insects:** a) cancers; b) bees; c) mosquitoes; d) mites.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreign learners of preparatory division. – Vitebsk VSMU, 2016. – P. 129–137.

Practical activities

I. Fill in the table:

"Comparative characteristics of arthropods"

Signs	Class Crustacea	Class Arachnoidea	Class Insecta
Typical representative			
Segmentation			
Parts of body			
Covers			
Body cavity			
Digestive system			
Respiratory system			
Excretory system			
Circulatory system			
Nervous system, sense organs			
Reproductive system			
Reproduction			

Theme №26 Type Chordates. Class Amphioxus

Chordata (Chordates) type comprises about 40 000 species that populate all the living environment. Their distinguishing feature is the presence of an internal axial skeleton - chord. Over the chord is the central nervous system in the form of a tube. Under the axial skeleton is an intestinal tube, the front office which is penetrated near the gill slits. This part performs the functions and throat and respiratory system. Gills slits are saved or whole life (lancelet, fish) or exist only in its infancy (terrestrial vertebrates). On the ventral side, under the intestinal tube is the heart or its substitute vessel. Chordates have a number of traits characteristic and certain types of invertebrates: bilateral body symmetry, per-hop arrangement of individual organ systems, secondary mouth, as well as the presence of a secondary body cavity.

The objective: 1. To study the general features of the organization and classification of chordates, structural features and Amphioxus life. 2. To give a general characterization of without cranium and vertebrates on the example of their representatives. 3. To view the diversity of vertebrates.

Get ready to speak about:

1. Chordata type. General characteristics of the type.
2. Class Cephalochordata. Features of the structure and Amphioxus life.

3. Vertebrates subtype. General characteristics.

Basic concepts and terms

Chordata – deuterostome type of animals, which have a cartilaginous support rod at a certain stage of development.

Vertebrates – subtype of chordates, in which the axial skeleton is represented by a flexible spine, consisting of cartilaginous or bony vertebrae.

Chord – axial skeleton, is a non-segmented strand along the animal's body.

Spine – flexible axial skeleton animals, consisting of separate cartilaginous or bony vertebrae.

Check tests

1. Representatives of type chordates: a) cancer; b) fish; c) birds; d) spiders.

2. Axial skeleton in chordates is: a) the spine; b) chord; c) is absent.

3. Body cavity in chordates is: a) primary; b) secondary; c) mixocoel; d) is absent.

4. Common features of chordates and invertebrates: a) secondary body cavity; b) bilateral symmetry; c) circulatory system of an open type; d) segments location of some organs; e) secondary mouth.

5. Location of heart in chordates: a) on the ventral side of the body; b) above the chord; c) on the dorsal side of the body.

6. Type Chordates includes subtypes: a) multicellular; b) uncephalon; c) vertebrates.

7. Representatives of uncephalon: a) fish; b) amphioxus; c) insects.

8. Nervous system in uncephalon is presented by: a) the neural tube on the dorsal side of the body; b) nerve trunks and nodes; c) ventral nerve cord.

9. Neural tube of Amphioxus is located: a) on the ventral side of the body; b) above the chord; c) chord.

10. Symmetry of a body in Amphioxus: a) bilateral; b) is absent; c) radial.

11. Skin of Amphioxus consist of: a) epidermis; b) subcutaneous fat; c) derma.

12. Parts of the digestive tube in Amphioxus: a) thorax; b) esophagus; c) the stomach; d) intestine.

13. Breathing in Amphioxus by: a) pulmonary; b) gill; c) tracheal.

14. Axial skeleton of Amphioxus: a) an outer chitin; b) spine; c) chord; d) is absent.

15. Amphioxus circulatory system is: a) closed; b) non-closed; c) is absent.

16. Heart of Amphioxus is: a) two compartment; b) three-compartment; c) is absent.

17. Organs of senses in Amphioxus: a) light-sensitive education; b) olfactory fossa; c) tactile cells; d) eye.

18. Amphioxus are: a) hermaphrodites; b) dioecious animals.

19. Amphioxus reproduction by: a) through sexual contact; b) by budding; c) fragmentation.

20. Fertilization in Amphioxus is: a) outside; b) internal; d) offline.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreign learners of preparatory division. – Vitebsk VSMU, 2016. – P. 137–140.

Practical activities

I. Fill in the table:

"Comparative characteristics of invertebrates and vertebrates uncephalon".

Signs	Invertebrates	Uncephalon	Vertebrates
Typical representatives			
Symmetry			
Axial skeleton			
Body cavity			
Digestive organs			
Respiratory organs			
Excretory organs			
Circulatory System			
Nervous System			
Reproductive system			
Reproduction			

Theme №27

Subclass Fish. Class Amphibians

Subclass Pisces (Fish) is aquatic vertebrates. Skin of fishes covered with scales. Sliding is paired (pectoral and pelvic) and unpaired (dorsal, caudal and anal) fins. All fish have cartilaginous or bony skeleton, which consists of the skull, spine, ribs and fin rays. The spine is divided into two parts: trunk and tail. Digestive system begins from mouth opening, leading to the oral cavity, followed by the pharynx, esophagus, stomach, small intestine and back. There are salivary glands, pancreas and liver. Respiratory system is represented by gills, excretory organs - mesonephros. The circulatory system in fish is closed, is represented by one circulation. The heart is two-chambered (atrium and ventricle). The central nervous system consists of the brain and spinal cord. The brain has five parts: anterior, intermediate, medium, long, and cerebellum. From the brain moves away 10 pairs of cranial nerves. From the spinal cord spinal nerves depart. They reproduce by sexual.

Class Amphibian is terrestrial vertebrates. The features of amphibians are skin-pulmonary respiration, two circulation circles, three-chambered heart (2 atria and ventricle), five-fingered limbs type. Skeleton is boned, presented the skull, spine and limb bones. The spine consists of a neck, trunk, sacral and caudal sections. Belt forelimbs up sternum, paired crow bones, clavicle and scapula. Hindquarters belt is formed by three pairs of fused pelvic bones. Free forelimb separated shoulder, forearm, wrist, and back – on the thigh, calf, foot. Authorities release is mesonephros. The central nervous system consists of the brain and spinal cord. In connection with the emergence of limb spinal nerves form the brachial and lumbosacral plexus.

The objective: 1. To study the features of the structure and functioning of fish and amphibians. 2. To give a description of the superclass Pisces and Amphibia class as an example of their representatives. 3. To view the health value of fish and amphibians.

Get ready to speak about:

1. Overview of the superclass Pisces.
2. Features of the structure and processes of life perch.
3. Class Amphibia. General characteristics.
4. Features of the structure and processes of life frog pond.

Basic concepts and terms

Anamniotes – protoaquatic lower vertebrates (fish, amphibians), who in embryogenesis are no embryonic membranes amnion and allantois.

Scales – outer covering fish presented horny or bony plates.

Gills – gas exchange organs of aquatic animals. Represent body growths with well-developed network of blood vessels, which is released through the walls of CO₂ and O₂ is absorbed.

Check tests

- 1. Organs of the fish movement:** a) fins; b) jointed limbs; c) are absent.
- 2. The paired fins of fishes:** a) thorax; b) back; c) abdominal.
- 3. Parts of fish spine:** a) neck; b) truncal; c) sacral; **d) tail.**
- 4. Respiration organs in fish:** a) light; b) gills; c) trachea; d) no.
- 5. Excretory organs of perch:** a) protonephridia; **b) mesonephros;** c) pelvic kidney; d) metanephridia.
- 6. Number of circulation in fish:** a) 1; b) 2; c) 4
- 7. Heart of fish consists of:** a) chamber; **b) two chambers;** c) three cameras.
- 8. Nervous system of perch consists of:** a) brain; **b) spinal cord;** c) cranial nerves; d) spinal nerves.
- 9. The number of cranial pairs of nerves in perch:** a) 10; b) 12; c) 20.
- 10. Organ of hearing in fish consists of:** a) inner ear; b) middle ear; c) outer ear.
- 11. Spine parts of amphibians:** a) neck; **b) truncal;** c) sacral; **d) tail.**
- 12. Bones of belt forelimb in amphibians:** a) raven; b) pelvic; c) clavicle; **d) blade;** e) sternum.
- 13. Bones of hind limb in amphibians:** a) raven; **b) pelvic;** c) clavicle; d) of the blade.
- 14. Composition of the front limbs of amphibians include:** a) the shoulder; b) the thigh; c) the forearm; **d) stop;** e) brush.
- 15. Structure of the rear limbs of amphibians include:** a) shoulder; **b) the thigh;** c) forearm; **d) stop;** d) shin.
- 16. Breathing in amphibians:** a) pulmonary; b) tracheal; c) gill; **d) skin.**
- 17. Number of circulation circles in amphibians:** a) 1; **b) 2;** c) 4.
- 18. Heart of amphibians consists of:** a) one camera; b) two chambers; c) three cameras.
- 19. Hearing organs in amphibians consist of:** a) inner ear; **b) middle ear;** c) outer ear.
- 20. Fertilization in amphibians:** a) outside; b) internal; d) offline.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreignlearners of preparatory division. – Vitebsk VSMU, 2016. – P. 140–146.

Practical activities

I. Fill in the table:

"Comparative characteristics of anamniotes"

Signs	Pisces	Amphibia
Typical representative		
Body covers, derivatives of dermis and epidermis		
Axial skeleton, its parts		
Digestive system		
Respiratory system		
Excretory system		
Circulatory system		
Nervous system, sense organs		
Reproductive system		
Reproduction		

Theme №28

Class Reptiles. Class Aves. Class Mammals

Class Reptilia (Reptiles) is the first real land animals. Their body is covered with horny scales. The skin is dry, almost without glands. The spine is divided into five sections: cervical, thoracic, lumbar, sacral and caudal. To align the edges of the thoracic vertebrae, which on the ventral side attached to the sternum form the thorax. In reptiles appear intercostal muscles involved in breathing. In the respiratory system other than the lung, there are airway (trachea and bronchi). Authorities release presented pelvic kidney. The circulatory system in reptiles has two circulations. Three-chambered heart: two atria and one ventricle. The ventricle is the incomplete partition. Anterior cortex of the brain is appeared firstly in reptiles. From the brain move away 12 pairs of cranial nerves. Reptiles are dioeciously animals. Fertilization is internal. The development of the fetus takes place in an aqueous medium, due to the presence of the embryonic membranes - amnion.

Class Aves (birds) is the higher vertebrates, have a constant body temperature, forelimbs that evolved into wings. Their body is compact, streamlined. The skin is thin, dry, almost devoid of glands. Due to the epidermis formed claws, scales, feathers, beak horn cover. Skeleton of birds is durable and lightweight due to coalescing of a number of bone, as well as the presence of air cavities in the bones. The digestive system of birds is characterized by the absence of teeth. Authority capturing and holding food is beak. In birds, there is the phenomenon of double breathing. Due to the presence of air (lung) bags of gas exchange in the lungs takes place on inhalation and exhalation. Excretory organs are the pelvic kidney. They do not have bladder. The circulatory system of birds is characterized by complete separation of arterial and venous blood flow. Heart is quad (two atria and two ventricles). In birds, there is a progressive development of the brain. There is a double of the accommodation. Birds are dioecious animals. The male reproductive system is a steam room, a female – unpaired.

Class Mammalia (Mammals) is the most highly organized class of vertebrates. Mammals are characterized by the progressive development of the central nervous system, the presence of hair, nurturing children in a special organ - the uterus and feeding them with milk. The skin shows a multilayer epidermis and proper skin, transforming into the subcutaneous tissue. The skin is rich in sebaceous and sweat glands. The derivatives of the sweat glands are the mammary glands. Cervical spine in all mammals consists of seven vertebrae. Only mammals are characterized by the presence of the diaphragm, the alveolar structure of the lungs, the differentiation of teeth. The brain has a relatively large size due to the increase of the cerebral hemispheres. The bark of the anterior part of most species has grooves. Hearing organ consists of inner, middle and outer ear. In the middle ear cavity there are three ossicles.

The objective: 1. To study the features of the structure and functioning of reptiles, birds and mammals. 2. To be able to give a description of the class Reptilia class Aves and Mammalia class as an example of their representatives. 3. Read the medical value of amniotes.

Get ready to speak about:

1. Class Reptilia. General characteristics of the class.
2. Features of the structure and processes of life sand lizard.
3. Class Aves. General characteristics of the class.
4. Features of the structure and processes of life pigeon.

5. The class Mammalia. General characteristics of the class.
6. Features of the structure and processes of life of the dog.

Basic concepts and terms

Amniotes – higher vertebrates (reptiles, birds, mammals), who formed in embryogenesis embryonic membranes amnion, allantois and amnion, etc.

Amnion – forms a cavity filled with fluid, which protects the embryo from mechanical damage and provides the aquatic environment for its development.

Air (pulmonary) bags – smooth-blind outgrowths of the lung in birds; do not perform the respiratory function.

Check tests

1.Parts of spine reptiles: a) the neck; b) lumbar; c) rib; d) sacral; e) tail.

2.Organs of the respiratory system of reptiles: a) light; b) gills; c) trachea; d) bronchial tubes; e) are not available.

3.Excretory organs of reptiles: a) protonephridia; b) mesonephros; c) pelvic kidney; d) metanephridia.

4.Number of pairs of cranial nerves in reptiles: a) 10; b) 12; c) 20.

5. Do any of the animals in the ventricle of the heart is the incomplete partition: a) fish; b) amphibians; c) reptiles; d) birds; e) mammals.

6.Fertilization in reptiles: a) outside; b) internal; c) is missing.

7. Do any of the animals has the front part of the brain cortex: a) fish; b) amphibians; c) reptiles; d) birds; e) mammals.

8.Heart of birds is: a) two compartment; b) three compartment; c) four compartment.

9.Respiratory system of birds is represented by: a) light; b) air bags; c) bronchi; d) trachea.

10. Animals who have observed the phenomenon of double breathing: a) fish; b) amphibious; c) reptiles; d) birds; e) mammals.

11.Blooded animals include: a) fish; b) amphibious; c) reptiles; d) birds; e) mammals.

12.Birds body is covered by: a) scales; b) feathers; c) hair.

13.Number of vertebrae in the cervical part of mammals: a) 1; b) 7; c) 12.

14.Mammary glands of mammals it is derived of: a) sweat glands; b) sebaceous glands; c) gonads.

15.Differentiation of teeth is characteristic for: a) fish; b) amphibians; c) reptiles; d) birds; e) mammals.

16. Respiratory in mammals: a) gills; b) cellular light; c) alveolar lungs.

17. Organ of hearing in mammals is represented by: a) inner ear; b) middle ear; c) outer ear.

18. How many ossicles in the middle ear cavity of a mammal: a) 1; b) 2; c) 3.

19. Mammalian heart is composed of: a) one atrium and one ventricle; b) one of the two atria and ventricle; c) two atria and two ventricles.

20. Excretory organs of mammals: a) protonephridia; b) the mesonephros; c) renal pelvis.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreign learners of preparatory division. – Vitebsk VSMU, 2016. – P. 146–160.

Practical activities

I. Fill in the table:

«Comparative anatomy of Amniots»

Signs	Reptilia	Aves	Mammalia
Typical representative			
Covers of body, derivatives epidermis			
Axial skeleton, its parts			
Digestive system			
Respiratory system			
Excretory system			
Circulatory system			
Nervous system, sense organs			
reproductive system			
Reproduction			

Theme №29

Animals (summing-up class)

The objective: 1. To find out the degree of assimilation of knowledge on the specifics of the structure and functioning of unicellular and multicellular

animals. 2. To give a description of the classes by the example of their representatives, indicate systematic position of animals.

Get ready to speak about:

1. Zoology as a science. Classification. The value of animal to humans.
2. Type Sarcomastigophora. Class Sarcodina. Amoeba Proteus.
3. Type Sarcomastigophora. Class Zoomastigota. Euglena green.
4. Type Infusoria. Class Ciliata. Ciliate-shoes.
5. Type Apicomplexa. Class Sporozoa. Malarial plasmodium.
6. Type Coelenterata. General characteristics of the type. Classification.
7. Class Hydrozoa. Structure and livelihoods of Hydra.
8. Plathelminthes type. General characteristics of the type.
9. Class Trematoda. Medical value of flukes.
10. Class Cestoidea. Medical value of tapeworms.
11. Nematelminthes type. General characteristics of the type. Medical value of roundworms.
12. Type Annelida. General characteristics of the type.
13. Type Mollusca. General characteristics of the type.
14. Type of Arthropoda. General characteristics of the type. Classification.
15. Class Crustacea. Class features an example of crayfish.
16. Class Arachnoidea. Feature class example of spider Araneus. Mites, their medical importance.
17. Class Insecta. General characteristics of the class. The role of insects in nature and human life.
18. Type Chordata. General characteristics and classification type.
19. Class Cephalochordata. Features of the structure and functioning.
20. Class Pisces. Classification, structure and features of the vital processes in connection with the life in the water.
21. Class Amphibia. General characteristics of the class.
22. Class Reptilia. General characteristics of the class.
23. Class Aves. General characteristics of the class.
24. Class Mammalia. General characteristics of the class.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreign learners of preparatory division. – Vitebsk VSMU, 2016. – P.

Practical activities

I. Specify the systematic position of the representatives of the different classes of animals (by individual assignments).

Theme №30
Human. Main types of tissues

The human body is self-regulating system. Features of the structure of the human body and of life science study such as anatomy, physiology and hygiene.

Anatomy is the science of the structure of the human body, its organs and systems. Physiology is the study of the processes of life and the mechanisms of their regulation in cells, tissues, organs, organ systems and organism as a whole. Human health is the science of the influence of living and working conditions on human health, its performance, longevity. The structural unit of the human body is a cell. The cells are similar in structure, have a common origin and the same function are combined into tissues.

According to the functions they perform tissue divided into four groups: epithelial, connective, muscle and nerve. All tissues are closely interrelated and form organs – separate parts of the body, with a definite structure and function. Each body is composed of several kinds of tissues, one of which is predominant. Agencies that provide certain functions are combined in the body system. The integrity of the body is provided with two mechanisms of regulation – humoral and nervous, which are interrelated and complement each other. Through the neuro-humoral regulation mechanism ensures continuous human adaptation to changing environmental conditions.

The objective: 1. To study the features of the structure and function of epithelial, connective, muscular and nervous tissues. 2. To give a morphological characterization of tissue in connection with the functions to be performed. 3. Learn some basic disciplines of anatomy, physiology and hygiene.

Get ready to speak about:

1. Anatomy, physiology and hygiene of the person as a science.
2. The main types of tissues (epithelial, connective, muscle tissue, nerve tissue), their structure and function.
3. The organs and organ systems. The organism as a whole.

Basic concepts and terms

Tissue – set of cells, similar in origin, structure, and functions.

Humoral regulation – coordinating the physiological and biochemical processes in the body, is carried out through the liquid medium (blood, lymph, interstitial fluid) using various hormones and biologically active substances.

Check tests

1. Structure of the human body and its organs studies: a) physiology; b) zoology; c) anatomy; d) hygiene.

2. Science that studies the functions of the body, individual organs and their systems: a) hygiene; b) physiology; c) histology.

3. Science of creating an environment conducive to human health: a) hygiene; b) zoology; c) anatomy; d) physiology.

4. Cells are similar in structure, origin, and functions it is: a) organ; b) tissue; c) the system of organs; d) organism.

5. Team officials, performing together common functions is: a) tissue; b) body; c) system of organs.

6. Kinds of epithelial tissues: a) fat; b) a single layer; c) glandular; d) multi-layered.

7. Function of epithelial glandular tissue: a) protection; b) secretory; c) to stock up.

8. Function of multilayer epithelium: a) protection; b) secretory; c) to stock up.

9. Types of connective tissue: a) blood; b) bone; c) fat; d) is smooth; e) cartilage.

10. Functions of bone: a) blood-forming; b) support; c) protection.

11. Function of adipose tissue: a) a support; b) secretory; c) to stock up.

12. Functions of cartilage: a) contractile; b) support; c) protection.

13. Blood cells: a) trombocytes; b) osteocytes; c) red blood cells; d) the leukocytes; e) neurons.

14. Types of muscle tissue: a) cartilage; b) smooth; c) striated.

15. Function of muscle tissue: a) contractile; b) secretory; c) transport.

16. Striated muscle tissue is a part of: a) skeletal muscle; b) the muscles of internal organs.

17. Proteins of muscle tissue, contractile function of performing: a) actin; b) ossein; c) myosin.

18. Cells of the nervous tissues: a) neurons; b) osteocytes; c) red blood cells; d) myocytes.

19. Properties of the nervous tissue: a) anxiety; b) contractility; c) conduction.

20. Signal form of the nervous regulation of: a) secret; b) hormone; c) boost.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreignlearners of preparatory division. – Vitebsk VSMU, 2016. – P. 161–166.

Practical activities

I. Fill in the table:

"Human tissues"

Type of tissue	Variety	Main functions	Location
Epithelial	Simple epithelium		
	Multilayer epithelium		
	Glandular epithelium		
Connective	Bone		
	Cartilage		
	Fibrous		
	Blood		
	Lymph		
	Fat		
Muscle	Smooth		
	Striated		
Nervous			

Theme №31 Musculoskeletal system

Musculoskeletal system is one of the most important systems of the human body. It consists of skeleton and skeletal muscles. Musculoskeletal system performs supporting, protecting, motor, hematopoietic function, and is also

involved in mineral metabolism. In the human skeleton are three divisions: the torso skeleton (spine and rib cage), limb bones and the skeleton of the head (skull). For the three types of typical human bones compound: fixed (by means of seams or by fusion of bones), semifixed (using cartilage) and movable (joints). Muscles are an active part of the locomotor system, providing movement of the body and its parts. Skeletal muscle consists of striated muscle tissue. Each muscle is enclosed in connective tissue sheath. On tendon ends are muscle, through which they are attached to bones. Muscles are abundantly supplied with blood vessels and nerves.

The objective: 1. To study the features of the structure and meaning of the musculoskeletal system. 2. To give a description of the axial skeleton, skeleton limbs, skull; classify the muscles of the body departments. 3. To familiarize with features of muscle physiology, as well as the value of exercise for the formation of the skeleton and muscles.

Get ready to speak about:

1. Musculoskeletal system, its value.
2. The composition and structure of bones.
3. A compound of the bone.
4. The skeleton of the trunk, limbs and head.
5. Skeletal muscle, their structure and function.

Basic concepts and terms

Skeleton – totality of the body of bones connected to each other by means of connective, cartilage and bone.

Skull – skeleton head.

Check tests

1. **Bone cells:** a) neurons; b) osteoblasts; c) the osteoclasts; d) osteocytes.
2. **Spine consists of:** a) the neck; b) chest; c) a lumbar; d) sacral; e) coccyx.
3. **Number of vertebrae in the cervical spine:** a) 7; b) 12; c) 10; d) 4.
4. **Number of vertebrae in the thoracic spine:** a) 7; b) 12; c) 10; d) 5.
5. **Number of vertebrae in the lumbar spine:** a) 7; b) 12; c) 10; d) 5.
6. **Number of vertebrae in the lumbosacral spine:** a) 7; b) 12; c) 10; d) 5.

7. Number of ribs pairs which attach to the sternum: a) 8; b) 10; c) 7; d) 12.

8. Bones of the shoulder girdle: a) scapulas; b) humerus; c) clavicle; d) sternum.

9. Free upper limb bones are: a) the shoulder; b) radiation; c) femur; d) elbow; e) bone paintbrush.

10. Bones of the hand: a) wrist; b) of the humerus; c) the pastern; d) phalanges.

11. Free bones of lower limb: a) shoulder; b) thigh; c) small cannon; d) tibia; e) bones of the foot.

12. Bones of the foot: a) wrist; b) tarsus; c) pastern; d) shank; e) phalanges.

13. Connection of bones neurocranium: a) moving; b) fixed; c) semimoving.

14. Paired bone of neurocranium: a) frontal; b) temporal; c) the bow; d) the parietal.

15. Unpaired bone neurocranium: a) frontal; b) occipital; c) the bow; d) the parietal.

16. Muscles that perform similar functions: a) synergists; b) antagonists; c) homologous.

17. Muscles that perform opposite functions: a) synergists; b) antagonists; c) homologous.

18. Muscles of the head: a) three-headed; b) temporal; c) biceps; d) mimic.

19. Muscles of the upper limb: a) three-headed; b) the diaphragm; c) biceps; d) mimic.

20. Muscles that are involved in the act of breathing: a) three-headed; b) the diaphragm; c) intercostal; d) mimic.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreign learners of preparatory division. – Vitebsk VSMU, 2016. – P. 185–189.

Practical activities

I. Fill in the table:

"The skeleton of the head"

Bones of the skull	Bones which form them
Facial part	
Brain part	

"Structure of the skeleton of the upper and lower extremities"

Part of skeleton		Bones they form
Upper limb	Girdle	
	Free limb	
Lower limb	Girdle	
	Free limb	

**Theme №32
Digestive system**

Digestion is the process of mechanical and chemical processing of food, in which the nutrients are absorbed and digested in the gut and undigested residues and the final decay products are removed from the body. Machining is grinding, mixing and grinding food to a state of slurry. Chemical treatment is carried out with the help of food enzymes digestive juices. In this complex organic matter are broken down into simpler: proteins – amino acids up to, fats – fatty acid to glycerol, carbohydrates – to monosugars. Digestive system consists of the digestive tract and digestive glands (salivary, pancreas, liver). Alimentary canal has the following parts: the mouth, pharynx, esophagus, stomach, small and large intestines.

The objective: 1. To study the features of the structure of the digestive system and digestive processes. 2. To indicate enzymes that are secreted into different parts of the gastrointestinal tract, and their meaning. 3. Be familiar with the specificity of enzymes and digestive juices conditions affecting their activity.

Get ready to speak about:

1. Digestion. Digestive enzymes and their role.
2. General plan of structure of human digestive system.
3. Structure and function of the oral cavity. Digestion in the mouth.

4. Stomach. Processing food in the stomach.
5. Structure and function of the intestine. Digestion in the small intestine.
6. Liver, pancreas and their role in the body.
7. Nervous and humoral regulation of the digestive process.

Basic concepts and terms

Digestive enzymes – biologically active substances secreted by glands of external secretion into the lumen of the digestive tract.

Pepsin – enzyme that breaks down proteins into peptides.

Chymotrypsin – enzyme that breaks down proteins into peptides and amino acids.

Maltase – enzyme that breaks down maltose into glucose.

Lipase – enzymes that break down fats into fatty acids and glycerol.

Amylase - enzymes that break down starch to maltose.

Check tests

1. Process of physical and chemical processing of food is: a) grinding the food; b) dissolving the food; c) digestion.

2. In oral cavity open ducts of: a) liver; b) pancreas; c) salivary glands.

3. During digestion proteins are broken down into: a) glycerol and fatty acids; b) amino acids; c) glucose; d) nucleotides.

4. In the process of starch digestion is split up: a) glucose; b) nucleotides; c) amino acids; d) glycerol and fatty acids.

5. In the process of digestion the fats are broken down into: a) glucose; b) amino acids; c) nucleotides; d) glycerol and fatty acids.

6. Enzymes active in saliva: a) acidic medium; b) weakly alkaline medium; c) neutral environment.

7. In the environment of the stomach is: a) alkaline; b) neutral; c) acidic.

8. In the small intestine medium is: a) alkaline; b) neutral; c) acidic.

9. In the stomach are broken: a) water; b) proteins; a) starch; d) mineral salts.

10. Most of the nutrients absorbed into: a) stomach; b) esophagus; c) small intestine; d) liver.

11. Hepatic duct opens into: a) duodenum; b) stomach; c) oral cavity; d) esophagus.

12. Bile is produced by: a) pancreas; b) cells of the stomach; c) liver.

13. Function of liver: a) storage of glycogen; b) blood depot; c) bile formation; d) neutralization of poisons; e) synthesis of blood proteins.

14. Role of bile: a) emulsifies fats; b) increases peristalsis; c) activate pancreatic enzymes and intestinal juice; d) breaks down proteins.

15. Saliva enzymes: a) an amylase; b) pepsin; c) lipase; d) maltase.

16. Enzymes of gastric juice: a) an amylase; b) pepsin; c) chymosin; d) maltase.

17. Enzymes of intestinal juice: a) maltase; b) pepsin; c) lipase.

18. Pancreatic enzymes are: a) amylase; b) trypsin; c) lipase; d) chymotrypsin.

19. The lipases cleave: a) proteins; b) fats; c) carbohydrates; d) nucleic acid.

20. The processes taking place in the colon: a) reabsorption of water; b) formation of feces; c) splitting proteins; d) splitting cellulose.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreign learners of preparatory division. – Vitebsk VSMU, 2016. – P. 204–214.

Practical activities

I. Fill in the table:

"Digestive enzymes"

Secret	Enzymes	pH of the medium, providing enzyme activity	Substrate	Products of lysis
Saliva				
Gastric juice				
Pancreatic juice				
Secret of intestinal glands				

Theme №33

Respiratory system

Breath is a set of processes to ensure the intake of oxygen and removal of carbon dioxide, and the use of cells of oxygen for the oxidation of organic substances with a release of energy. When breathing out of the body removed some end products of the oxidation of organic compounds and water. Breathing

in human organs presented the lungs and pneumatic ways. Airways serve to conduct air into the lungs. These include the nasal cavity, nasopharynx, larynx, trachea, bronchi and bronchioles. Lungs are located in the chest, closely adhering to its walls. The surface of the lungs-coated - pleura, consisting of two layers. Between the sheets has a closed space - pleural cavity with a small amount of liquid. Pleural fluid facilitates sliding pleura during respiration. Lightweight fabric is formed by small bubbles - the alveoli, covered with a dense network of capillaries. When breathing oxygen permeates from the blood into the alveolar air, and carbon dioxide - from the blood into the alveoli. Blood provides gas transport. In tissues occurs gas exchange between the cells and in blood, oxygen is supplied to the cells in the blood - carbon dioxide.

The objective: 1. To study the features of the structure and functioning of the respiratory system. 2. To give a morpho-functional characteristic of the respiratory tract and lungs. 3. To view the regulation of the processes of respiration.

Get ready to speak about:

1. Value of breathing. External and tissue respiration.
2. Respiratory, their structure.
3. Gas exchange in the lungs and tissues.
4. Respiratory Motion (inhalation and exhalation). The concept of vital capacity.
5. Nervous and humoral regulation of breathing.

Basic concepts and terms

Lungs – paired cone-shaped breathing organs in terrestrial vertebrates.

External respiration – gas exchange between the alveoli of the lungs and blood.

The cell or tissue respiration – gas exchange between blood and tissues.

Alveoli – vesicular formation in the lungs of mammals, braided network of capillaries.

Check tests

1. Organs of the respiratory system: a) airways; b) lungs; c) kidney; d) heart.

2. Airways include: a) nasal cavity; b) nasopharynx; c) larynx; d) trachea; e) bronchi.

- 3. Number of shares in the right lung:** a) 1; b) 2; c) 3; d) 4.
- 4. Number of shares in the left lung:** a) 1; b) 2; c) 3; d) 4.
- 5. Alveolar wall comprises of:** a) single layer of epithelium and a thin layer of elastic fibers; b) stratified epithelium; c) cartilaginous half-rings.
- 6. Surface of the lung is covered by:** a) muscles; b) pleura; c) cartilage.
- 7. In the nasal cavity occurs:** a) warm air; b) humidification; c) dehumidification; d) purification of air from dust.
- 8. Trachea is consists of:** a) single layer of the epithelium; b) muscles; c) cartilaginous half-rings.
- 9. Vocal cords are located in:** a) nasopharynx; b) larynx; c) trachea.
- 10. Types of breathing:** a) external; b) mixed; c) tissue.
- 11. External breath is:** a) gas exchange in the tissues; b) gas exchange in the lungs; c) transport of gases.
- 12. Tissue respiration is:** a) gas exchange between the cells and the blood; b) gas exchange in the lungs; c) transport of gases.
- 13. Amount of oxygen in the inhaled air:** a) 21%; b) 0.03%; c) 16%; d) 4%.
- 14. Amount of carbon dioxide in the inhaled air:** a) 21%; b) 0.03%; c) 16%; d) 4%.
- 15. Amount of oxygen in the exhaled air:** a) 21%; b) 0.03%; c) 16%; d) 4%.
- 16. Amount of carbon dioxide in exhaled air:** a) 21%; b) 0.03%; c) 16%; d) 4%.
- 17. Gas exchange in humans occurs in the:** a) tissue; b) trachea; c) lung; d) oral cavity.
- 18. Compound of hemoglobin with oxygen:** a) karbogemoglobin; b) oxyhemoglobin; c) methemoglobin.
- 19. Compound of hemoglobin with carbon dioxide:** a) karbogemoglobin; b) oxyhemoglobin; c) methemoglobin.
- 20. Respiratory center is located in:** a) cerebellum; b) medulla oblongata; c) diencephalon.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreign learners of preparatory division. – Vitebsk VSMU, 2016. – P. 200–204.

Practical activities

I. Fill in the table:

"Organs of the respiratory system"

Organ	Features of structure	Functions
Nasal cavity		
Larynx		
Trachea		
Bronchi		
Lungs		

Theme №34 Excretory system.Skin

Excretion is the process of removing from the body of final waste products produced by the decay of organic matter. The function of removing the decay products carry the kidneys, lungs, intestines, sweat glands of the skin. Human excretory system consists of a pair of kidneys and excretory ducts, which include the ureters, bladder, urethra.

The kidneys are paired bean-shaped organs located on either side of the spine at the level of the lumbar vertebrae. In kidney distinguish the outer (cortical) and internal (cerebral) layers. The structural and functional unit of the kidney is the nephron. The nephron begins in the cortex of the kidney capsule Shymlanskaya shaped double-walled bowl, inside which there is a ball of blood capillaries. Between the walls of the capsule has a cavity which extends from the first order tubule. He goes into the medulla, it forms a loop and returns to the cortex. There it forms a convoluted tubule of the second order, which flows into the brood in the collecting duct or tube. The last merge to form a common ducts. The urine flows from the kidneys and the ureters in them into the bladder. By nephron suitable artery (bringing the vessel). It breaks down in the capsule in the capillaries, forming a ball. Glomerular capillaries gather in efferent vessel. Introducing vessel branches into capillaries, which are densely braid convoluted tubules of the first and second order, and then going into the veins. urine formation proceeds in two phases. First phase is filtration (filter substances from the blood into the cavity of the capsule of the nephron). The resulting liquid is called primary urine. In the second phase (phase reabsorption) water absorption occurs, glucose, amino acids and other organic compounds from the primary urine back into the blood. As a result, a secondary

urine. Skin epidermis is formed and the actual skin (dermis). Derma goes into the subcutaneous fat. The derivatives of the epidermis nails are derived dermis - the hair. In the dermis of the skin are the sweat and sebaceous glands. The skin has a protective, excretory, thermoregulatory function, as well as a sensory organ of touch.

The objective: 1. To study the features of the structure and functioning of the excretory organs, and skin. 2. To give a morphofunctional characteristic of the kidneys and skin. 3. Read the nervous and humoral regulation of renal function.

Get ready to speak about:

1. Excretion. The organs of the excretory system.
2. Structure of the kidney. Nephron.
3. Formation of the primary and secondary urine.
4. Nervous and humoral regulation of renal function.
5. Structure and function of the skin.

Basic concepts and terms

Nephron – structural unit of the kidney, is a double-walled capsule, which is located inside a ball of blood capillaries.

Hair – horny formation of the dermis, consisting of a rod, and the root of the hair bulb.

Sweat glands – skin glands secrete fluid, which consists of salt, urea, uric acid, ammonia and other substances.

Sebaceous glands – glands of the skin, which produce sebum. Sebum is composed of fatty acids, vitamins (A, D, E) and serves to lubricate the hair and skin.

Subcutaneous adipose tissue – loose connective tissue between the fibers which are located fat lobules.

Check tests

1. Organs of the excretory system include: a) kidney; b) lungs; c) ureters; d) bladder; e) urethra.

2. Structural and functional unit of the kidney: a) alveoli; b) nephron; c) neuron.

3. Kidney is consists of: a) medulla; b) cortex; c) muscles.

4. Capsule Shymlanskaya is situated in: a) cortex; b) medulla; c) cortical and medullary layers.

5. Phases of urine formation: a) filtering; b) allocation; c) reabsorption.

6. The formation of primary urine occurs in: a) capsules Shymlanskaya; b) convoluted tubules I and II of the order; c) ureters.

7. Volume formed by the primary urine per day: a) 30 liters; b) 150-170 L; c) 1 500 liters; d) 1.5-2 liter.

8. Composition of primary urine: a) water; b) glucose; c) amino acids; d) uric acid, urea; e) ammonia.

9. Secondary urine is carried out in: a) convoluted tubules I and II orders; b) capsule Shymlanskaya; c) bladder.

10. Composition of the secondary urine: a) water; b) glucose; c) amino acids; d) uric acid; e) urea.

11. Volume formed by the secondary urine per day: a) 150-170 liter; b) 1.5-1.7 l; c) 60-120 L.

12. Filtering takes place in: a) capsule Shymlanskaya; b) renal tubule; c) bladder.

13. Function of the ureters: a) accumulation of urine; b) holding the urine; c) synthesis of substances.

14. Urine collects in: a) ureters; b) kidney; c) bladder; d) urethra.

15. Functions of the skin: a) secretory; b) thermoregulatory; c) protection; d) transport; e) receptor.

16. Derivatives of the epidermis are: a) hair; b) nails; c) hair bags.

17. Derivatives of the dermis are: a) hair; b) nails; c) claws.

18. In fact the skin is formed by: a) muscle tissue; b) nervous tissue; c) connective tissue.

19. Layers of the epidermis: a) superficial horny; b) the average; c) sprout.

20. Skin glands: a) greasy; b) salivary; c) sweat.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreign learners of preparatory division. – Vitebsk VSMU, 2016. – P. 214–219.

Practical activities

I. Fill in the table:

"The bodies of the excretory system"

Organ	Features of structure	Function
Kidney		
Ureters		
Bladder		
Urethra		

«The structure of the skin»

Layer	Origin	Features of structure
Epidermis		
Dermis		
Subcutaneous adipose tissue		

**Theme №35
Circulatory system**

The movement of blood through the vessels, ensuring the exchange of substances between the organism and the environment is called circulation. Circulatory system includes the heart and blood vessels (arteries, capillaries, veins). The heart is a hollow muscular organ consisting of four chambers: two atria and two ventricles. The right atrium communicates with the right ventricle through the tricuspid valve and the left atrium to the left ventricle - through the butterfly valve. The wall of the heart consists of three layers: the inner (endocardial), average muscle (myocardium) and outer (epicardium). Outside the heart is covered with the pericardium. Blood is moves through the vessels due to contraction of the heart. In humans, the blood moves through a closed circulatory system consisting of large and small circulation. Large circulation starts from the left ventricle and the right atrium ends. From the left ventricle of the heart blood is moves to the aorta. From the aorta artery depart, which are divided into arterioles and capillaries. From the capillaries the blood is collected in venules, which merge to form veins. Two of the large vein isupper and lower hollow carry blood into the right atrium. From the capillaries of the systemic circulation cells receive oxygen and nutrients, and release carbon dioxide and other waste products. In all arteries of the arterial blood is flow circle and veins – venous. Small circulation from the right ventricle begins and ends with the left atrium. From the right ventricle of the heart receives deoxygenated blood in the pulmonary artery, which divided into two arteries that carry blood to the right and left lung. In lung arteries is branch into capillaries where gas exchange

occurs. Oxygenated arterial blood flows through the pulmonary veins to the left atrium.

The purpose of the activity: 1. Know the composition of the blood, especially the structure and functioning of the circulatory system. 2. To be able to characterize the work of the heart cycle. 3. Read the nervous and humoral regulation of the circulatory system.

Get ready to speak about:

1. Blood, its composition. The structure and function of blood cells. Blood groups.
2. Blood circulation. Bodies of circulation.
3. Heart, its structure and operation. Nervous and humoral regulation of cardiac activity.
4. Vessels (arteries, veins, capillaries), their structure and function.
5. Movement of blood through the vessels. Large and small circulation.
6. Pulse. Blood pressure.

Basic concepts and terms

Arteries – blood vessels that carry oxygen-rich blood from the heart to the organs and tissues.

Veins – blood vessel that carry blood is saturated with carbon dioxide from the organs and tissues to the heart.

Capillaries – smallest vessels, which are exchanged between blood and tissue gases and other substances.

Pulse – periodic jerky extension of the walls of arteries, synchronous contraction of the heart.

Check tests

1. **Blood is:** a) epithelial tissue; b) nervous tissue; c) connecting tissue.
2. **Blood cells:** a) leukocytes; b) red cells; c) myocytes; d) platelets.
3. **Erythrocytes are formed:** a) bone marrow; b) of the liver; c) yellow bone marrow; d) spleen.
4. **Role of red blood cells:** a) protection; b) transport of gases; c) trophic.
5. **White blood cells are formed:** a) red bone marrow; b) thymus; c) yellow bone marrow; d) spleen.
6. **Role of white blood cells:** a) transport of gases; b) protection; c) provide a blood clotting.

7. Role of platelets: a) transport of gases; b) trophic; c) provide a blood clotting.

8. Number of chambers in the human heart: a) 2; b) 3; c) 4.

9. In the left half of the heart blood: a) arterial; b) venous; c) mixed.

10. In the right half of the blood of the heart: a) arterial; b) venous; c) mixed.

11. Large circulation starts from: a) right ventricle; b) right atrium; c) the left ventricle; d) of the left atrium.

12. Pulmonary circulation starts from: a) right ventricle; b) right atrium; c) left ventricle; d) of the left atrium.

13. The arteries of the systemic circulation blood: a) arterial; b) venous; c) mixed.

14. In the arteries, pulmonary circulation blood: a) arterial; b) venous; c) mixed.

15. Vessels that carry blood to the heart are: a) arteries; b) veins; c) capillaries.

16. Vessels that carry blood from the heart are: a) arteries; b) vein; c) capillaries.

17. Phases of the cardiac cycle: a) ventricular systole; b) diastole of the heart; c) atrial systole.

18. Duration of the cardiac cycle: a) 0.1 seconds; b) 0.3 seconds; c) 0.4 seconds; d) 0,8 seconds.

19. Duration of atrial systole: a) 0.1 seconds; b) 0.3 seconds; c) 0.4 seconds; d) 0,8 seconds.

20. Average heart rate per minute: a) 40-45 strokes; b) 70-75 strokes; c) 100-105 beats.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreignlearners of preparatory division. – Vitebsk VSMU, 2016. – P. 189–200.

Practical activities

I. Fill in the table:

"Blood cells"

Element of blood	Features of structure	Content of cells in 1 mm ³	Functions
Erythrocytes			
White blood cells			
Platelets			

«Blood groups of human by ABO system»

Group	Gene	Genotype	Agglutinogenes of erythrocytes	Agglutinins of plasma
I (O)	I^0	$I^0 I^0$		
II (A)	I^A	$I^A I^A; I^A I^0$		
III (B)	I^B	$I^B I^B; I^B I^0$		
IV (AB)	$I^A I^B$	$I^A I^B$		

**Theme №36
Nervous system**

The nervous system controls the activities of all organs and body systems, as well as the body communicates with the external environment. The nervous system is divided into central and peripheral. The main function of the central nervous system is a higher nervous activity. The central nervous system includes the brain and spinal cord, peripheral – 12 pairs of cranial nerves, 31 pairs of spinal nerves and ganglia located near the bodies. The spinal cord is located in the spinal canal. It has the form of a cylindrical shape with a cavity inside the tube (the spinal canal). Spinal cord composed of gray (neuronal cell bodies) and white matter (nerve fiber). The main functions of the spinal cord is reflex and conductor. The brain is an extended part of the neural tube. The brain distinguishes five departments: anterior, intermediate, middle, rear (the bridge and the cerebellum) and oblong.

The objective: 1. To study the features of the structure and functioning of the central and peripheral nervous system. 2. To specify links of the reflex arc, giving morpho-functional characteristic of the spinal cord and the brain. 3. To view the role of somatic and autonomic nervous system in human life.

Get ready to speak about:

1. The value of the nervous system.
2. Reflex. The reflex arc.
3. Central nervous system. The structure and function of the spinal cord.
4. Brain. The structure and function of its parts.
5. Peripheral nervous system.

6. Autonomic and somatic part of the nervous system.

Basic concepts and terms

Axon – single, rarely branched, motor process of the nerve cell, transmits nerve impulses from the cell body to other neurons or effector organs.

Dendrite – short branching process sensitive neuron, conducting nerve impulses from the receptors to the neuron body.

Neuron – nerve cell; It consists of a body of motor (axons) and sensitive (dendrites) processes.

Reflex – reaction of the body, carried by the nervous system in response to external or internal stimuli.

Reflex arc – path that passes a nerve impulse in the implementation of reflex; receptor consists of a sensitive neuron, central nervous system, and motor neuron section.

Check tests

1. Sensory neuron processes: a) axons; b) dendrites; c) neuroglia.

2. Moving neuron processes: a) axons; b) dendrites; c) neuroglia.

3. Central nervous system include: a) cranial nerves; b) spinal cord; c) brain; d) spinal nerves.

4. Sensory neurons transmit nerve impulses: a) from the receptor to the CNS; b) from the CNS to the working body; c) on the central nervous system receptor.

5. Motor neurons transmit nerve impulses: a) from the receptor to the CNS; b) from the CNS to the working organ; c) on the central nervous system receptor.

6. Bodies of sensory neurons are situated in: a) anterior horns of the spinal cord; b) posterior horns of the spinal cord; c) anterior roots of the spinal cord; d) posterior roots of the spinal cord.

7. Bodies of motor neurons are located in: a) anterior horns of the spinal cord; b) posterior horns of the spinal cord; c) anterior roots of the spinal cord; d) posterior roots of the spinal cord.

8. Bodies of neurons are: a) anterior horns of the spinal cord; b) posterior horns of the spinal cord; c) anterior roots of the spinal cord; d) the posterior roots of the spinal cord.

9. Number of spinal nerves: a) 20 pairs; b) 12 pairs; c) 31 pair; d) 46 pairs.

10. Functions of the spinal cord: a) reflex; b) motor; c) wiring.

11. Number of divisions in the human brain: a) 2; b) 3; c) 5.

12. Center located in: a) cerebellum; b) elongated section; c) average of department; d) intermediate section.

13. Respiratory centers are located in: a) cerebellum; b) elongated section; c) average of the department; d) intermediate section.

14. Coordination of movement controls: a) cerebellum; b) elongated section; c) average department; d) intermediate section.

15. Muscle tone controls: a) elongated section; b) average department; c) an intermediate division.

16. Hypothalamus is situated in: a) cerebellum; b) elongated section; c) average of the department; d) intermediate section.

17. Bark of the front part of the brain is made up of: a) gray substance; b) white solid; c) nerves.

18. Sympathetic nervous system: a) expanding the pupil; b) dilates blood vessels; c) increases the rate of heart rhythm; d) constricts blood vessels.

19. Parasympathetic nervous system: a) narrows the bronchial tubes; b) dilates blood vessels; c) increases the rate of heart rhythm; d) lowers blood pressure.

20. Number of cranial nerves: a) 20 pairs; b) 12 pairs; c) pair 31; d) 46 pairs.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreignlearners of preparatory division. – Vitebsk VSMU, 2016. – P. 166–180.

Practical activities

I. Fill in the table

"Brain"

Name of section	Function
Front part of the brain	
Intermediate section	
Average section	
Cerebellum	
Elongated section	

Theme №37

Endocrine glands

Endocrine glands are specialized bodies of vertebrate animals and humans which have no excretory ducts and emit produced substances (hormones) directly into the blood or lymph. Hormones have high biological activity. Proceeding into the bloodstream, they spread throughout the body and carry humoral regulation, stimulating or inhibiting the functions of different organs and systems. By the endocrine glands include the pituitary, thyroid, adrenal glands. In contrast to the endocrine glands exocrine glands have ducts and produce waste products into the environment or into the cavity of the internal organs. The pancreas and gonads, having both foreign and endocrine function, are mixed glands. Central endocrine gland is the pituitary gland. Thanks to the development of tropic hormones, it regulates the other endocrine glands.

The objective: 1. To study the features of the structure and functioning of the endocrine glands. 2. To explain the physiological effects of hormones. 3. Read the diseases caused by a violation of the endocrine glands function.

Get ready to speak about:

1. Endocrine glands and their meaning. Hormones.
2. Endocrine activity of the pituitary gland.
3. Endocrine activity of the thyroid gland.
4. Endocrine activity of the adrenal glands.
5. Endocrine activity of the pancreas.
6. Endocrine activities of gonads.
7. Role of humoral regulation in the life of the organism.

Basic concepts and terms

Hormones – biologically active substances secreted by glands of internal secretion, or clusters of specialized cells in the body in the blood and provides targeted action on other organs and tissues.

Humoral regulation – coordination of physiological and biochemical processes in the body, carried by fluids (blood, lymph, tissue liquid) by means of hormones and various biological active substances.

Gland of internal secretion – glands does not have excretory ducts and releasing his secret (hormones) in the blood or lymph.

Check tests

1. Endocrine glands: a) pancreas; b) thyroid gland; c) adrenals; d) salivary gland; e) pituitary.

2. Gland secretions mixed: a) pancreas; b) thyroid gland; c) adrenals; d) gonads; e) pituitary.

3. Exocrine glands: a) sweat glands; b) pituitary gland; c) salivary gland; d) adrenals.

4. Endocrine glands produce: a) vitamins; b) antibody; c) hormones.

5. Hormones of the anterior pituitary: a) melanotropin; b) thyroid-stimulating hormone; c) oxytocin; d) vasopressin; e) growth hormone.

6. Hormone of middle lobe of the pituitary: a) melanotropin; b) thyroid-stimulating hormone; c) oxytocin; d) vasopressin; e) growth hormone.

7. Hormones of posterior pituitary: a) melanotropin; b) epinephrine; c) oxytocin; d) vasopressin; e) growth hormone.

8. With a lack of growth hormone is developed: a) dwarfism; b) myxedema; c) diabetes; d) gigantism.

9. With an excess of growth hormone is developed: a) dwarfism; b) acromegaly; c) diabetes; d) gigantism.

10. Thyroid hormones: a) thyroxine; b) epinephrine; c) oxytocin; g) triiodothyronine; d) growth hormone.

11. With a lack of thyroxine is developing: a) cretinism; b) myxedema; c) diabetes; d) gigantism.

12. When an excess of thyroxine is developing: a) dwarfism; b) acromegaly; c) diabetes; d) Graves' disease.

13. With a lack of iodine in the body develops: a) Graves' disease; b) dwarfism; c) diabetes; d) goiter.

14. Adrenal hormones: a) thyroxine; b) epinephrine; c) oxytocin; d) aldosterone; e) growth hormone.

15. With a lack of adrenal hormones develops: a) cretinism; b) bronze disease; c) diabetes; d) gigantism.

16. Adrenaline causes: a) vasodilation; b) increase in blood pressure; c) vasoconstriction.

17. Hormones of the pancreas: a) thyroxine; b) epinephrine; c) insulin; d) glucagon; e) growth hormone.

18. With a lack of insulin develops: a) dwarfism; b) myxedema; c) diabetes; d) gigantism.

19. With an excess of insulin develops: a) dwarfism; b) hypoglycemia; c) diabetes; d) Graves' disease.

20. Hormones of sexual glands: a) adrenaline; b) testosterone; c) progesterone; d) estrogens.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreign learners of preparatory division. – Vitebsk VSMU, 2016. – P. 180–185.

Practical activities

I. Fill in the table:

"Endocrine glands"

Title of gland	Hormones	Hypofunction	Hyperfunction
Thyroid			
Pituitary			
Adrenal glands			
Pancreas			
Testes			
Ovaries			

Theme №38

Reproduction of human

Man is dioecious by the body, which is characterized by sexual dimorphism. In the process of evolution are formed male and female reproductive systems. Male reproductive system consists of the internal reproductive and of the external genitalia. The internal organs of the female reproductive system include the ovaries, fallopian tubes, uterus and vagina. External genitalia include large and small labia, clitoris. Start a new body gives the zygote, which is formed by the merger of ovarium and sperm at fertilization. From that moment, the human embryonic development begins. In human embryogenesis distinguish three periods: early (first week), embryo (2-8 weeks) and fetal (9 weeks before delivery).

In the early embryonic period and crushing processes occur, gastrulation, organogenesis and histogenesis. From one part of the embryo cells of tissues and organs are formed next body of different - embryonic membranes. The man

is completely formed, only two embryonic membranes: the chorion and amnion. The physiological process of development of the unborn child is called pregnancy in the mother. Its duration is about 280 days. Pregnancy ends with the physiological process of the expulsion of the fetus - birth. Since the birth of the child begins post-embryonic development period. Postembryonic human development is divided into prereproductive, reproductive and postreproductive periods.

The objective: 1. To study the features of the structure and functioning of the reproductive system, individual human development. 2. To give a description of pre-natal and post-embryonic development of man. 3. Read the harmful effects of alcohol, nicotine and drugs on human development.

Get ready to speak about:

1. Structure of the male reproductive system.
2. Structure of the female reproductive system.
3. Features of oogenesis in human. Fertilization.
4. Features of human embryonic development. Embryonic shell. Childbirth.
5. Features of post-embryonic development of man.
6. Harmful effects of alcohol, nicotine and drugs on the development of the human body.

Basic concepts and terms

Ovulation – egg from the ovary into the body cavity.

Follicle – immature egg is surrounded by a layer of epithelial (follicular) cells.

Placenta – body responsible for the link between the mother's body and fetus in utero.

Fetal – human body in the period from the 9th week of embryonic development before birth.

Childbirth – physiological process of the expulsion of the fetus and placenta from the uterus in placental mammals and humans.

Check tests

1. External male genitalia: a) ovaries; b) scrotum; c) testicles; d) penis.

2. Internal male sex organs: a) testes; b) seminal vesicles; c) prostate gland; d) penis; e) epididymis testis.

- 3. External female genital organs:** a) ovaries; b) labia; c) testicles; d) clitoris.
- 4. Internal female sex organs:** a) ovaries; b) testicles; c) fallopian tubes; d) uterus; e) vagina.
- 5. In testis produce:** a) sperm; b) egg; c) sex hormones.
- 6. Ovaries are formed:** a) sperm; b) egg; c) sex hormones.
- 7. Role of the vas deferens:** a) formation of hormones; b) semen excretion; c) transport of eggs.
- 8. Process of egg release from the mature follicle:** a) periods; b) birth; c) ovulation; d) pregnancy.
- 9. Fertilization occurs in a person:** a) uterus; b) vagina; c) fallopian tube; d) ovary.
- 10. Corpus luteum forms:** a) sperm; b) the egg; c) hormones.
- 11. Development of the fetus in humans occurs in the:** a) uterus; b) fallopian tube; c) ovary.
- 12. Rejection of the mucous membrane of the uterus:** a) periods; b) ovulation; c) pregnancy.
- 13. Embryonic membranes in the human fetus:** a) amnion; b) yolk sac; c) chorion; d) allantois.
- 14. Chorionic functions in the fetus a person:** a) protection; b) trophic; c) respiratory; d) blood-forming; e) excretory.
- 15. Value of the amnion to the human fetus:** a) ensure the development in the aquatic environment; b) protects the fetus against mechanical impacts, and sticking to the shells; c) forms the placenta.
- 16. Physiological process of development of the child in the mother's body:** a) periods; b) ovulation; c) pregnancy; d) birth.
- 17. Physiological fetal expulsion process is called:** a) periods; b) ovulation; c) pregnancy; d) birth.
- 18. Periods of embryonic humans:** a) start; b) final; c) embryo; d) fetal.
- 19. Periods of post-embryonic development:** a) prereproductive; b) reproductive; c) initial; d) postreproductive.
- 20. In which period there is rapid growth of the organism:** a) prereproductive; b) reproductive; c) postreproductive.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreign learners of preparatory division. – Vitebsk VSMU, 2016. – P. 219–223.

Practical activities

I. Fill in the table:

"Postembryonic development of human"

Period	Processes
Prereproductive	
Reproductive	
Postreproductive	

Theme №39

Human (final session)

The objective:To find out the degree of assimilation of students knowledge on the specifics of the structure and functioning of human organ systems.

Get ready to speak about:

1. Anatomy, physiology and hygiene of the person. Tissues: epithelial, connective, muscular, nervous.
2. Musculoskeletal system and its functions. Structure of the long bones. The compounds of the bones.
3. Skeleton of the trunk, limbs and head.
4. Skeletal muscle, their structure and function.
5. Digestion. Ingestion.
6. Structure and function of the oral cavity. Digestion in the mouth.
7. Stomach. Processing food in the stomach.
8. Structure and function of the intestine. Digestion in the small intestine.
9. Liver, pancreas and their role in the body.
10. Respiratory, their structure.
11. Gas exchange in the lungs and tissues. The concept of vital capacity.
12. Structure of the kidneys. Primary and secondary formation of urine.
13. Skin, its structure and functions.
14. Blood, its structure and functions.
15. Circulation. The movement of blood through the vessels. Large and small circulation. Pulse. Blood pressure.
16. Heart and his work. Arteries, capillaries and veins.

17. Nervous system. The value of the nervous system. Reflexes. The reflex arc.
18. Central nervous system. Spinal cord, its structure and function.
19. Brain, its departments. The structure of the brain and their functions.
20. Peripheral nervous system. The somatic and autonomic (sympathetic and parasympathetic divisions) nervous system.
21. Glands of internal secretion. Hormones, their role in the life of the organism.
22. Structure of the male reproductive system.
23. Structure of the female reproductive system.
24. Features of individual human development.

Literature

Bekish V.J., Zoryna V.V. Biology: for foreignlearners of preparatory division. – Vitebsk VSMU, 2016. – P.

ANSWERS

Topic №1: 1 - a; 2 - a, b; 3 - b; 4 - b; 5 - a; 6 - a; 7 - c; 8 - c; 9 - a; 10 - a; 11 - b; 12 - b; 13 - a, b, c, d; 14 - b; 15 - b, b; 16 - b, c, e; 17 - c; 18 - d; 19 - b; 20 - d.

Topic №2: 1 - c; 2 - a; 3 - c; 4 - a, d; 5 - b; 6 - a; 7 - c, d; 8 - c; 9 - b, d; 10 - a, b, c, d, e; 11 - a, b, c, d; 12 - b, c, d; 13 - a, d; 14 - c, d; 15 - b, c; 16 - b, c; 17 - c; 18 - a, b; 19 - a, b; 20 - a, c, d, e; 21 - c.

Topic №3: 1 - c; 2 - a; 3 - c; 4 - a, d; 5 - c; 6 - b; 7 - a, b, c, d; 8 - a, c, d; 9 - c; 10 - b, c, d; 11 - a, b, c, e; 12 - b; 13 - b; 14 - c; 15 - b; 16 - a, b, c, d; 17 - c; 18 - a; 19 - b; 20 - a.

Topic №4: 1 - a, b, c; 2 - b; 3 - a, c, d; 4 - b, c, d; 5 - b, c, d; 6 - a, b, c; 7 - a, c; 8 - a, b, c; 9 - b, c, d; 10 - b; 11 - b, c, d; 12 - a, d; 13 - a, b; 14 - b; 15 - a; 16 - a, b; 17 - d; 18 - a, b; 19 - c; 20 - b.

Topic №5: 1 - b, c, d, e; 2 - a, b, c, d; 3 - a; 4 - b; 5 - c; 6 - d; 7 - a, c; 8 - a, b, c, d; 9 - c; 10 - c; 11 - a, b; 12 - b; 13 - b; 14 - c; 15 - a; 16 - b, d; 17 - b; 18 - a, d; 19 - b, d; 20 - b.

Topic №6: 1 - b; 2 - a; 3 - a; 4 - c; 5 - c; 6 - a; 7 - b, c, d; 8 - c; 9 - d; 10 - a; 11 - a; 12 - b, c; 13 - a, b; 14 - b, c; 15 - b, c, d; 16 - b, c; 17 - c; 18 - b, c; 19 - c; 20 - c.

Topic №7: 1 - a; 2 - a, c, d; 3 - b; 4 - a; 5 - b; 6 - b, d; 7 - b; 8 - c; 9 - a, c, e; 10 - b; 11 - c; 12 - b, c, d, e; 13 - a, b; 14 - a, b; 15 - a; 16 - b; 17 - b, c, d; 18 - c; 19 - a; 20 - b.

Topic №8: 1 - a, b; 2 - b, c; 3 - a, b, c, d; 4 - b, c, d; 5 - a, c, d; 6 - a, b; 7 - b, c, d; 8 - d; 9 - e; 10 - c; 11 - a; 12 - b; 13 - a, b, c, d; 14 - a, c, d; 15 - b; 16 - a; 17 - b, c, d; 18 - a, d, e; 19 - b; 20 - d.

Topic №9: 1 - a; 2 - b, c; 3 - d; 4 - a, b, c; 5 - a; 6 - a, d; 7 - c; 8 - b; 9 - a, b; 10 - a, b, d; 11 - b, c, d; 12 - b; 13 - a, b, c; 14 - a; 15 - b, c, d; 16 - a, c; 17 - a, b, d; 18 - a, b, c, d; 19 - b; 20 - b.

Topic №11: 1 - b; 2 - a; 3 - c; 4 - a, c; 5 - a; 6 - c; 7 - b; 8 - a; 9 - a; 10 - b; 11 - a; 12 - b; 13 - a; 14 - c; 15 - a; 16 - b; 17 - c; 18 - b; 19 - a; 20 - b.

Topic №12: 1 - a; 2 - b; 3 - a; 4 - b; 5 - a, c; 6 - b, c; 7 - b, d; 8 - a, c; 9 - b; 10 - a, c; 11 - b, c; 12 - b; 13 - c; 14 - a; 15 - a; 16 - c; 17 - b; 18 - c; 19 - a; 20 - b.

Topic №13: 1 - b, c; 2 - a, c; 3 - b, c; 4 - b; 5 - a, b, c; 6 - a, c; 7 - b, c; 8 - a, b, c; 9 - a, b, d; 10 - a, b, c, d; 11 - b, d; 12 - a, c; 13 - a; 14 - b; 15 - c; 16 - c; 17 - b, c; 18 - b, c; 19 - b; 20 - a, b, d.

Topic №15: 1 - c, d; 2 - c; 3 - b, c; 4 - c; 5 - a, c; 6 - b; 7 - a, b; 8 - a; 9 - b; 10 - c; 11 - c; 12 - a; 13 - a, c; 14 - a, c; 15 - b, c, d; 16 - a; 17 - a, b, c; 18 - c, d; 19 - a, b; 20 - b, c.

Topic №16: 1 - a; 2 - a; 3 - b, c, d; 4 - a, b, d; 5 - a, b; 6 - c, d; 7 - b; 8 - a; 9 - a, b, c, d; 10 - a, b; 11 - c; 12 - b; 13 - c; 14 - a, c; 15 - b; 16 - b; 17 - a; 18 - a, b, c; 19 - a, b, c; 20 - a, c.

Topic №17: 1 - a, c, d; 2 - a, b, e; 3 - a, c, d, e; 4 - a, b, c, d, e; 5 - a, b, c, d, e; 6 - b; 7 - c; 8 - a, b, c, d; 9 - a, d; 10 - d; 11 - c; 12 - a, c; 13 - b, c, d; 14 - d; 15 - b; 16 - b; 17 - b; 18 - d; 19 - a; 20 - c.

Topic №18: 1 - a, b; 2 - a; 3 - b; 4 - b; 5 - a; 6 - b; 7 - a; 8 - b; 9 - c; 10 - b; 11 - a; 12 - c; 13 - a, b, c; 14 - b; 15 - a; 16 - c; 17 - a, b; 18 - c; 19 - a; 20 - a.

Topic №19: 1 - c; 2 - b; 3 - b; 4 - b, c; 5 - a; 6 - a; 7 - b; 8 - a; 9 - a; 10 - c; 11 - a; 12 - b; 13 - a; 14 - d; 15 - b; 16 - c; 17 - b; 18 - c; 19 - d; 20 - a, c, d.

Topic №21: 1- d; 2 - a; 3 - c; 4 - b; 5 - d; 6 - a; 7 - a; 8 - a; 9 - c, d; 10 - a; 11 - a; 12 - c; 13 - b; 14 - a, c; 15 - b; 16 - a, b, c; 17 - a; 18 - b; 19 - d; 20 - b, c, d.

Topic №22: 1- b; 2 - a, b, c, e; 3 - d, e; 4 - b; 5 - a; 6 - c; 7 - b; 8 - a, b; 9 - c; 10 - b, c; 11 - c; 12 - a; 13 - c; 14 - a, b; 15 - c; 16 - a; 17 - a, b; 18 - c; 19 - a; 20 - b.

Topic №23: 1- a; 2 - a; 3 - a, b, c; 4 - a; 5 - a, b, c; 6 - c; 7 - a; 8 - c; 9 - a, c, d; 10 - b; 11 - a, d; 12 - c; 13 - b, c; 14 - a; 15 - a, b; 16 - a; 17 - c; 18 - a, b, c, d; 19 - b, c, e; 20 - a.

Topic №24: 1- a; 2 - b; 3 - a; 4 - c; 5 - b; 6 - c, d; 7 - c; 8 - a; 9 - a, d; 10 - b, c; 11 - a, b, c; 12 - c; 13 - b, c; 14 - a, b; 15 - b; 16 - b; 17 - b; 18 - d; 19 - b; 20 - a, c.

Topic №25: 1- b; 2 - c; 3 - b; 4 - a; 5 - a, c, d; 6 - c, d; 7 - b; 8 - b; 9 - b; 10 - a, b, c; 11 - a, c; 12 - a; 13 - c; 14 - a, b, d; 15 - b, c; 16 - b; 17 - c; 18 - a, b, c; 19 - b; 20 - b, c.

Topic №26: 1- b, c; 2 - a, b; 3 - b; 4 - a, b, d, e; 5 - a; 6 - b, c; 7 - b; 8 - a; 9 - b; 10 - a; 11 - a, c; 12 - a, d; 13 - b; 14 - c; 15 - a; 16 - c; 17 - a, b, c; 18 - b; 19 - a; 20 - a.

Topic №27: 1- a; 2 - a, c; 3 - b, d; 4 - b; 5 - b; 6 - a; 7 - b; 8 - a, b, c, d; 9 - a; 10 - a; 11 - a, b, c, d; 12 - a, c, d, e; 13 - b; 14 - a, c, e; 15 - b, d, e; 16 - a, d; 17 - b; 18 - c; 19 - a, b; 20 - a.

Topic №28: 1- a, b, c, d, e; 2 - a, c, d; 3 - c; 4 - b; 5 - c; 6 - b; 7 - c, d, e; 8 - c; 9 - a, b, c, d; 10 - d; 11 - d, e; 12 - b; 13 - b; 14 - a; 15 - e; 16 - c; 17 - a, b, c; 18 - c; 19 - c; 20 - c.

Topic №30: 1- c; 2 - b; 3 - a; 4 - b; 5 - c; 6 - b, c, d; 7 - b; 8 - a; 9 - a, b, c, e; 10 - a, b, c; 11 - c; 12 - b, c; 13 - a, c, d; 14 - b, c; 15 - a; 16 - a; 17 - a, c; 18 - a; 19 - a, c; 20 - c.

Topic №31: 1- b, c, d; 2 - a, b, c, d, e; 3 - a; 4 - b; 5 - d; 6 - d; 7 - c; 8 - a, c; 9 - a, b, d, e; 10 - a, c, d; 11 - b, c, d, e; 12 - b, d, e; 13 - b; 14 - b, d; 15 - a, b; 16 - a; 17 - b; 18 - b, d; 19 - a, c; 20 - b, c.

Topic №32: 1- c; 2 - c; 3 - b; 4 - a; 5 - d; 6 - b; 7 - c; 8 - a; 9 - b; 10 - c; 11 - a; 12 - c; 13 - a, b, c, d, e; 14 - a, b, c; 15 - a, d; 16 - b, c; 17 - a, c; 18 - a, b, c, d; 19 - b; 20 - a, b, d.

Topic №33: 1- a, b; 2 - a, b, c, d, e; 3 - c; 4 - b; 5 - a; 6 - b; 7 - a, b, d; 8 - c; 9 - b; 10 - a, c; 11 - b; 12 - a; 13 - a; 14 - b; 15 - c; 16 - d; 17 - a, c; 18 - b; 19 - a; 20 - b.

Topic №34: 1- a, c, d, e; 2 - b; 3 - a, b; 4 - a; 5 - a, c; 6 - a; 7 - b; 8 - a, b, c, d, e; 9 - a; 10 - a, d, e; 11 - b; 12 - a; 13 - b; 14 - c; 15 - a, b, c, e; 16 - b; 17 - a; 18 - c; 19 - a, c; 20 - a, c.

Topic №35: 1- c; 2 - a, b, d; 3 - a; 4 - b; 5 - a, b, d; 6 - b; 7 - c; 8 - c; 9 - a; 10 - b; 11 - c; 12 - a; 13 - a; 14 - b; 15 - b; 16 - a; 17 - a, b, c; 18 - d; 19 - a; 20 - b.

Topic №36: 1- b; 2 - a; 3 - b, c; 4 - a; 5 - b; 6 - d; 7 - a; 8 - b; 9 - c; 10 - a, c; 11 - c; 12 - b; 13 - b; 14 - a; 15 - b; 16 - d; 17 - a; 18 - a, c, d; 19 - a, b, d; 20 - b.

Topic №37: 1- b, c, e; 2 - a, d; 3 - a, c; 4 - c; 5 - b, e; 6 - a; 7 - c, d; 8 - a; 9 - b, d; 10 - a, d; 11 - a, b; 12 - d; 13 - d; 14 - b, d; 15 - b; 16 - b, c; 17 - c, d; 18 - c; 19 - b; 20 - b, c, d.

Topic №38: 1- b, d; 2 - a, b, c, e; 3 - b, d; 4 - a, c, d, e; 5 - a, c; 6 - b, c; 7 - b; 8 - c; 9 - c; 10 - c; 11 - a; 12 - a; 13 - a, c; 14 - a, b, c, e; 15 - a, b; 16 - c; 17 - d; 18 - a, c, d; 19 - a, b, d; 20 - a.

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ДЛЯ ИНОСТРАННЫХ ГРАЖДАН ПОДГОТОВИТЕЛЬНОГО ОТДЕЛЕНИЯ

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