FEDERAL STATE BUDGETARY EDUCATIONAL INSTITUTION OF HIGHER EDUCATION
KUBAN STATE MEDICAL UNIVERSITY OF THE MINISTRY OF HEALTH OF THE RUSSIAN FEDERATION
(FGBOU IN KubSMU of the Ministry of Health of Russia)

Department of Biology with the Course of Medical Genetics

BIOLOGY

Workbook and Guidelines to Practical Classes

for 1st year Students of the Medical Faculty
Bilingual Form of Education

student _____

group № _____

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Study guide (workbook and methodological instructions for practical classes) under the heading "Biology" is compiled and revised on the basis of the Work program on biology in accordance with FGOS3 + Higher Education of the Russian Federation. It is intended for foreign students of all faculties of Medical University.

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Content

Preface

Methodological guide "**Biology. Workbook and Guidelines to Practical Classes for the 1st Year Students of the Medical Faculty, Bilingual Form of Education"** was developed by the Department of biology with the course of medical genetics on the basis of the Work program to meet requirements of FGOS3+ to the minimum content and training of specialists in the specialty 31.05.01. "General Medicine" and contributing to a better mastery of basic professional and professional competency by students.

The manual is compiled in the form of a workbook and includes four parts of practical training on biology: «Cell Biology», «Genetics», «Ontogeny. Phylogeny of Organ systems», «Parasitology».

For each lesson, the aim and objectives are defined, as well as the items for independent work; a list of references; problems for classwork and homework, basic definitions of the theme.

Methodological recommendations for the organization of independent work with definitions are aimed to develop the ability to search and process scientific information. In the course of independent work in the workbook, the student must fill in the definitions for each specific theme, using a methodological manual - a glossary and basic textbooks on biology . This kind of work helps to consolidate knowledge on this theme, as well as serve as an indicator of active independent work of the student.

In practical work, the student has the opportunity to make the necessary sketches and records in the workbook, thus allowing to rational distribution of all material of each class. At the end of each lesson there is a list of skills formed on the basis of the acquired knowledge. After checking the performance of the practical lesson, the teacher signs the workbook .

Introduction

Discipline Biology is the core for the implementation of further training and the formation of professional competency. The section "Cell Biology" reveals the main features of the organization of the cellular level of life: the structure of the cell, the organization of hereditary material and its implementation, cell reproduction. This knowledge will help further study of histology, biochemistry, and microbiology.

Genetics studies the basic laws of inheritance of traits, types of variability, the rate of reaction. Special importance is given to the study of mutagenesis and its significance in the development of pathology. The doctor needs to know modern methods used in the study of human genetics, genotypic and phenotypic manifestations of hereditary diseases, as well as principles of medical and genetic counseling.

Ontogeny, which includes elements of embryology, is one of the most important fields of biology for medical practice. Thus, the study of General patterns of embryogenesis on the example of the development of Vertebrate embryos helps to understand the complex mechanisms of human embryogenesis. Human organ systems were formed as a result of the transformation of ancestral forms. The doctor must know the main stages and direction of these transformations in order to understand correctly the origin and functions of these structures in humans, as well as the ontogenetic and phylogenetic provision of the relevant congenital malformations. Knowledge of the phylogeny of organ systems is the basis for the study of normal, pathological anatomy, physiology.

Parasitology is one of the major fields of biology. The knowledge of this section will be used by students in clinical departments, as well as for medical practice. Parasitism is a form of biotic antagonistic bond in nature. Practical exercises study forms of parasitism, classify parasites according to their place and time of localization in the body of the definitive and intermediate hosts. This section consists of medical protistology, studying the propagation, localization, methods of diagnostics and prevention of parasitic Protozoans. The section of helminthology studies the Types Flat Worms and Round Worms. In the third section of Arachnid Entomology students study morphological features of parasitic spiders and insects, relevant diseases, methods of diagnostics and preventive measures. The doctor should be aware of the propagation, diagnostics and prevention of parasitic diseases.

Basic literature

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2.Cell Biology Third Edition. // Thomas D. Pollard ; William C. Earnshaw ; Jennifer Lippincott-Schwartz ; Graham T. Jonson. Philadelphia : ELSEVIER, 2017.

3.Introduction to medical Parasitology : Textbook for students of the English-speaking Medium of Medical University / E. N. Makarenko [и др.]. Stavropol, 2017.

4.Level Biology for OCR Year 1 Student Boock// **Fullick Ann.** Oxford UP : Oxford Academ, 2015.

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Additional literature

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2.Биология: учеб. Для студентов мед. Вузов/ Под ред. Н.В. Чебышева. 2010 М.: ВУНМЦ;

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PART I "CELL BIOLOGY"

LESSON 1

"___" _____202_

THEME: Light Microscope and Magnifier. Microscopic Preparations of Biological Specimens and Microscopy Technique.

AIM: to learn the rules of practical work and writing of the protocol; to study the light microscope design and microscopy technique; to master the technique of temporary preparations; to study the advantages and disadvantages of living and fixed biological specimen microscopy; to study the principles of permanent preparations.

INDEPENDENT WORK :

1.Light microscope design (main parts).
2.Light microscope physical capabilities.
3.Light microscope and magnifier manual.
4.Types of medical and biological microscopic examination.
5.Examination (practical work) protocol registration rules.
6.Biological micro- and macro-preparations.
7.Temporary and permanent micro-preparations of biological specimens.
6.Temporary and permanent micro-preparation technique, general requirements.
7.Advantages and disadvantages of living and fixed biological objects microscopy.
8.Physical-chemical processes in the fixation of biological specimens.

INDEPENDENT WORK :

Write and Learn Basic Definitions :

Condenser-

Electron microscopy-

Fixation-

Fixators-

Focal length-

Light microscopy-

Lens-

Macrometric screw (Coarse adjustment knob)-

Micrometric screw- (Fine adjustment knob)-

Micro-preparation-

Microscope-

Microscopy-

Ocular (eyepiece)-

Permanent preparation-

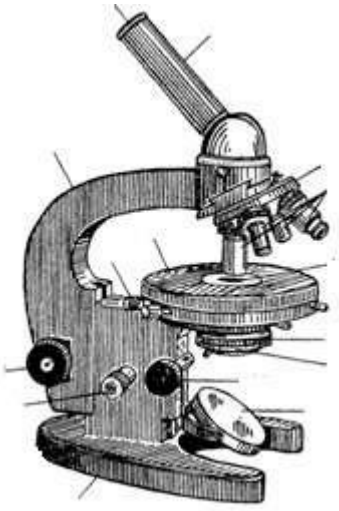
Temporary preparation-

Tube-

Vital microscopy-

CLASSWORK.

1. Learn the Rules of Laboratory Work.



2. Study the Design of the Light Microscope.

I. Mechanical Part:

1 –
2 –
3 –
4 –
5 –
6 –
7 –
8 –
9 –
10 –

II. Optical Part:

11 –
12 –

III. Illuminating Part:

13 –
14-
15 –

Fig. 1. Microscope WBM-1

3. Rules of Light Microscopy.

Learn the basic rules of working with the MBR-1 microscope. Record lens types, their focal length and resolution

Lens Magnification	Ocular (magnification rate)	Lens (magnification rate)	Focal length	Magnifying capacity
Low				
High				
Immersion				

4. Permanent Preparation and its Technique

4.1. Study the technique for permanent preparations

4.2. Study permanent preparations of biological specimens (whole and sections).

4.2.1. Study the preparation of human blood cells with a microscope at 7x8 and 7x40 magnification rate.

Develop the skill of changing low magnification to high magnification.

4.2.2. Immersion microscopy (mag. 7x90)- micro-preparation of human blood cells (Demonstration). Clarify the purpose and principle of immersion microscopy.

5. Technique for Temporary Preparations.

5.1. Microscopy of living plant cells.

Make the preparation, take a piece of onion peal (0.5x0.5 cm), put it on a glass slide, apply a drop of water, cover it with a coverslip. Study it at mag. 7x8 and 7x40, pay attention to the shape of the cells, their dullness, lack of visibility of cell structures. Sketch several cells at mag. 7x40. Clarify advantages and disadvantages of the method of vital microscopy.

Fig. 2. Onion Peel Cells.
7X40

5.2. Microscopy of fixed and stained plant cells.

Apply 2-3 drops of 70% alcohol (fixative) on a fresh peal of onion for 2 minutes. Rinse with water and apply a drop of 1% methylene blue solution (dye) for 2 minutes. Rinse with water, cover with coverslip, study at mag. 7x40. Pay attention to the clarity of cell shapes, the presence of stained structures in them. Draw and mark: membrane, cytoplasm, nucleus and nucleoli.

1-
2-
3-
4-

Fig. 3. Onion Peel Cells Stained with Methylene Blue.

NECESSARY SKILLS:

1. Microscope care.
2. Microscopy of biological objects preparations at a small and large magnification of the microscope.
3. Writing the protocol for microscopic examination.
4. Temporary micro-preparation of biological material.
5. Analyzing, sketching and marking the structure of the biological object.

Student_____Teacher_____.

LESSON 2

«_____»_____20__.

THEME: Cellular Level of Life. Methods of Cell Study .

AIM: to study the cell as an elementary living unit; structure of prokaryotic and eukaryotic cells.

INDEPENDENT WORK :

1. Basic features of living matter.
2. Organization levels of living matter.
3. Genesis of the cell organization of living matter.
4. Basic principles of cell theory.
5. Differences in the structure of prokaryotic and eukaryotic cells.
5. Organelles and inclusions of eukaryotic cells.
6. Cell study methods.

I**NDEPENDENT WORK:**

1. Write and Learn Basic Definitions :

Cell-

Cytology-

Cytoplasm-

Cytoplasm matrix-

Cytosol-

Double membrane-bound organelles-

Eukaryotes-

Core organelles-

Inclusions-

Organelles-

Plasmalemma-

Prokaryotes-

Single membrane-bound organelles-

Specialized organelles-

2. Methods of Cell Study.

Learn the basic methods of cell study. Study the aim of the investigation and the principles of these methods. Fill in the Chart.

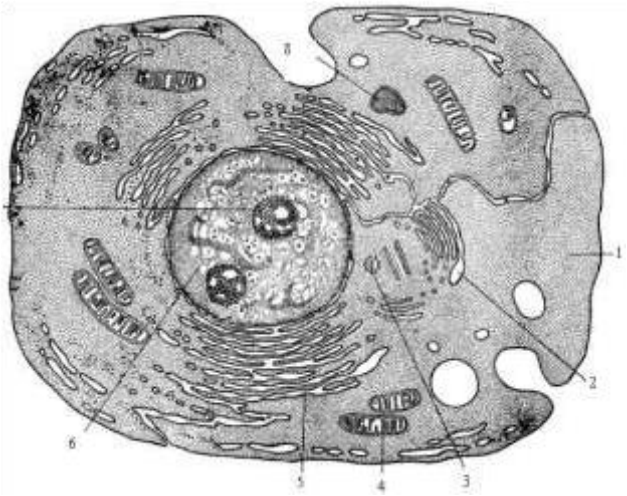
Characteristics of cytological research methods

Method	Purpose	Principle
Vital. microscopy		
Microscopy of fixated cells		
Cytophotometry		
Fractional centrifugation		
Autoradiography		
Cell culture		
Somatic cell Hybridization		
Electron microscopy		

CLASSWORK

1. Structure of Eukaryotic Animal Cells.

1.1. Study the electron pattern of the animal cell, identify structural components of the cell



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8-

1.2. Study human buccal epithelial cells.

Using a spatula, make a scraping from the mucous membrane of the cheek and transfer it to a glass slide. Apply 1-2 drops of dye - methylene blue to the object. Cover it with a coverslip. Study it at mag. 7x8 and 7x40. Pay attention to the shape of the cells and size of the nucleus. At mag. 7x40 sketch several cells, mark the cell membrane, cytoplasm and nucleus.

1-
2-
3-

Fig. 1. Human buccal epithelium. Mag. 7x40.

2. Stem Cells.

Study the types of stem cells, their characteristics and significance. Fill in the Chart. Study characteristics and significance of different stem cells.

Stem cell type	Characteristics	Medical use
Totipotent cells		
Polypotent cells		
Unipotent cells		
Reconstructed embryonic cells		

3. Method of Cell & Tissue Culture.

Study the technique of culture of human peripheral blood leukocytes. Record the main steps and their sequence.

1-

2-

3-

4-

5-

NECESSARY SKILLS:

1. Making the micro-preparation of an eukaryotic cell:
- make a sampling of biological material;
- fix the object;
- dye the preparation;
- make a microscopic analysis of cells.
2. Differentiating various organelles and cell inclusions.

Student_____Teacher _____

LESSON 3

« ___» _____202____г.

THEME: Matter and Energy Flow in the Cell.

AIM: to study structure and functions of cell membranes, cytoplasm physical- chemical properties; to study the cell reaction in media with different osmotic pressure.

INDEPENDENT WORK:

1. Cell as an open system.
2. Organization of matter and energy flow in the cell.
3. Physical and chemical properties of cytoplasm.
4. Structure and functions of cell membranes.
5. Transportation modes through cytoplasm membrane.
6. Osmotic phenomena in cells with different concentrations of soluble substances.

INDEPENDENT WORK:

1. Write and Learn Basic Definitions :

ATP-

Catabolism-

Cytolysis-

Deplasmolysis-

Diffusion-

Glycolysis-

Hemolysis-

Hypertonic medium-

Hypotonic medium-

Isotonic medium-

"Lacquered" blood-

Osmosis-

Osmotic pressure-

Oncotic pressure-

Paranecrosis-

Pinocytosis-

Phagocytosis-

Plasmolysis-

Saline-

Turgor-

2. Main Functions of Organic Compounds in Animal Cells.

Write down structural units and basic functions of organic substances in the Chart.

Organic substances	**Structural Units**	**Place of synthesis in the cell**	**Functions**
Proteins			
Lipids			
Carbohydrates			
Nucleic acids			
ATP			

CLASSWORK:

1. Osmotic Processes in a Plant Cell.

1.1. Turgor

Prepare a temporary preparation of onion peel cells in a drop of water (isotonic solution); observe the turgor state of cells at a large magnification of the microscope. Draw several cells. In the figure, designate the cell wall and protoplast.

1.2. Plasmolysis

Prepare a temporary preparation of onion cells in a drop of 10% NaCl solution (hypertonic solution). At high magnification study gradual exfoliation of the cytoplasm from the membrane and compaction of protoplast, i.e. a phenomenon of plasmolysis. Sketch 2-3 plasmolyzed cells, designate.

1.3. Deplasmolysis

Rinse the plasma cells in water, prepare again the preparation in a drop of
distilled water (hypotonic solution) and at mag. 7x40 study the phenomenon of deplasmolysis. Draw and designate the cell membrane and protoplast.

1– 2-

A) B) C)

Fig. 1. Onion Peel Cells in:

a) isotonic solution(water) - turgor;
b) hypertonic solution (10% solution of NaCl) - plasmolysis;
c) hypotonic solution (distilled water) - deplasmolysis. Mag. 7x 40

2. Osmotic Phenomena in Animal Cells.

2.1 Turgor

Place a drop of human blood in 0.9% NaCl (isotonic solution), at mag. 7x40.
Observe red blood cells in a state of turgor. Sketch red blood cell shape in isotonic solution.

2.2. Wrinkling.

Place a drop of human blood in 5% NaCl (hypertonic solution), with mag. 7x40 observe a change in the shape of red blood cells - wrinkling. Sketch the shape of red blood cells in a hypertonic solution.

1- 2-

A) B)

Fig. 2. Human Red Blood Cells in:

a) hypertonic solution (5% NaCl) - wrinkling;
b) saline (0.9% NaCl) - the state of turgor. Mag._7x 40

3. "Lacquered" Blood.

Add 1 ml of the saline (isotonic solution) to test tube No. 1, and 1 ml distilled water (hypotonic solution) to test tube No. 2. In both tubes add 2 drops of human blood, shake gently. Note the appearance of "lacquered" blood in test tube No. 2.

Tube No 1 Isotonic solution 0,9% NaCl

Tube No 2 Hypotonic solution Distilled water

NECESSARY SKILLS:

1. To make an experimental model of plant and animal cells (human red blood cells) in various solutions (isotonic, hypertonic, hypotonic).
2. To determine the state of "lacquered" blood in vitro and blood in saline.

Student_____Teacher_____.

LESSON 4

« ____»_____ 202____

THEME:Structure of the Cell Nucleus. Nucleic Acids. Organization of the Cell Information Flow.

AIM: to study the nucleus structure; nucleic acids structure and properties, the role of nucleic acids in the organization of the genetic apparatus and in biosynthetic processes of the cell.

INDEPENDENT WORK:

1. Structure and functions of the cell nucleus.
2. DNA and RNA structure; role in the cell life.
3. Organization of the cell information flow in protein biosynthesis.
4. Genetic code, its properties.
5. Mechanisms of regulation of gene activity in prokaryotes by Jacob and Monod.
6. The basic principles of the regulation of gene activity in eukaryotes.

INDEPENDENT WORK:

1. Write and Learn Basic Definitions :

Anticodon-

Codon-

DNA-

DNA-polymerase-

Exon-

Genetic code-

Intron-

Kilobase-

Nucleic acid-

Nucleus-

Nucleolus-

Nucleotide-

Operon-

Promoter-

Processing-

DNA Repair-

Replication-

RNA-

Splicing-

Transcription-

Translation-

2. Types and Functions of RNA.

Define the role of RNA in the biosynthetic processes of cells

mRNA –

_____
_____
_____

rRNA –

_____
_____
_____

tRNA –

_____
_____
_____

CLASSWORK:

1. Cell Nucleus.

Study the structure of the cell nucleus using the pictures and charts (nuclear shell, nucleoplasm, nuclear chromatin). The role of a nucleus in supporting life processes in the eukaryotic cell.

2. Nucleic Acids.

2.1. DNA structure and its properties.

Using models and charts study DNA structure and explain its properties. In the figure, designate the complementary nitrogenous bases included in the DNA, and the parameters of one DNA helix coil.

The length of one nucleotide DNA = 0.34nm The number of nucleotides per 1 coil = 10 pairs Step (coil) of a DNA helix = 3.4 nm or 34 A

1 nm (nanometer) = 1/1000000000 m

1 A (angstrom) = 1/10 nm = 1/10000000000 m

The distance between the DNA strands = 2 nm = 20 A The length of one nucleotide RNA = 0.34nm

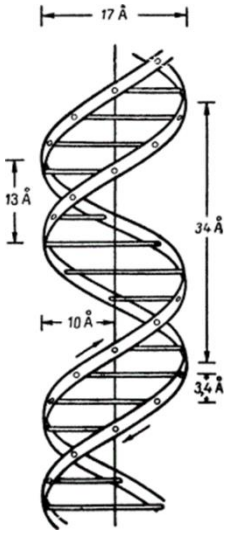


Fig. 1. Structure of the DNA Molecule according to J. Watson and F. Crick (1953).

2.2. Solve Problems.

3. Protein Biosynthesis in the Cell.

Using charts and figures study the sequence of biosynthetic processes in the cell. Solve Problems.

NECESSARY SKILLS :

1. Calculating the percentage of individual nucleotides in a DNA molecule using the Chargaff rule.
2. Calculating the length of the DNA molecule by the number of nucleotides
3. Finding the sequence of nucleotides in DNA and RNA formed during the matrix synthesis reactions (replication, transcription and translation).
4. Performing a protein molecule in accordance with the genetic code.

Student_____Teacher_____.

LESSON 5

« ____» _____20____ г.

THEME: Human Genome

AIM: to study organization of the hereditary material of eukaryotes; structure and types of chromosomes; to define the principles of chromosome identification and to learn how to make idiograms of human chromosomes.

INDEPENDENT WORK:

1. Organization of the hereditary material of eukaryotes.
2. Gene, its structure and properties.
3. Chromosome structure and chromosome types.
4. Chromosome theory provisions.
5. Chromosome classification in the human karyotype.

INDEPENDENT WORK:

1. Write and learn basic definitions :

Acrocentric chromosomes-

Centromere-

Chromatid-

Chromoneme-

Euchromatin-

Gene-

Genome-

Heterochromatin-

Homologous chromosomes-

Karyotype-

Karyogram-

Metacentric chromosomes-

Metaphase plate-

Satellite chromosome-

Telomere-

2. Properties of Genes.

Study the basic properties of genes, give a definition.

1. Specificity -
2. Pleiotropy -
3. Discreteness -
4. Dosage -
5. Expressivity -
6. Penetrance -
7. Stability -
8. Lability -
9. Multiple alleleism –
10. Allele -
11. Amplification -
12. Dominance -
13. Recessiveness –

CLASSWORK

1.Molecular Level of Hereditary Material Organisation.

1.1.Functional classification of genes.

Study functional classification of genes, write gene functions in the column.

Classification of Functional Genes in Pro- and Eukaryots

GENE	**GENE FUNCTIONS**
Operator	
Promotor	
Terminator	
Sensor gene	
Regulator	
Integrator	
Spacers	
Modulators:	
Enhancers	

Silencers	
Mutators	
Attenuators	
Antimutators	

1.1. Functional regions of DNA.

Study the functions of informative and non-informative regions of DNA, fill in the Chart.

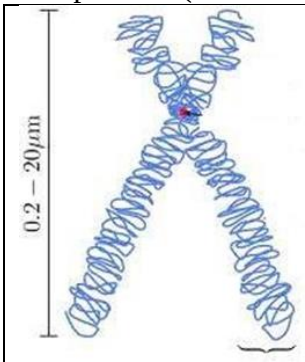
Functional regions of DNA

Informative regions of DNA	
Exons	
Non-informative regions of DNA	
Introns	
Spacers	
Satellite DNA	

2. Chromosomal Level of Hereditary Material Organization .

2.1. Structure of chromosomes.

Using micro-preparations and charts, study the structure of the chromosome. Draw and mark its components (centromere, shoulders (short - p, long - q), chromatid).

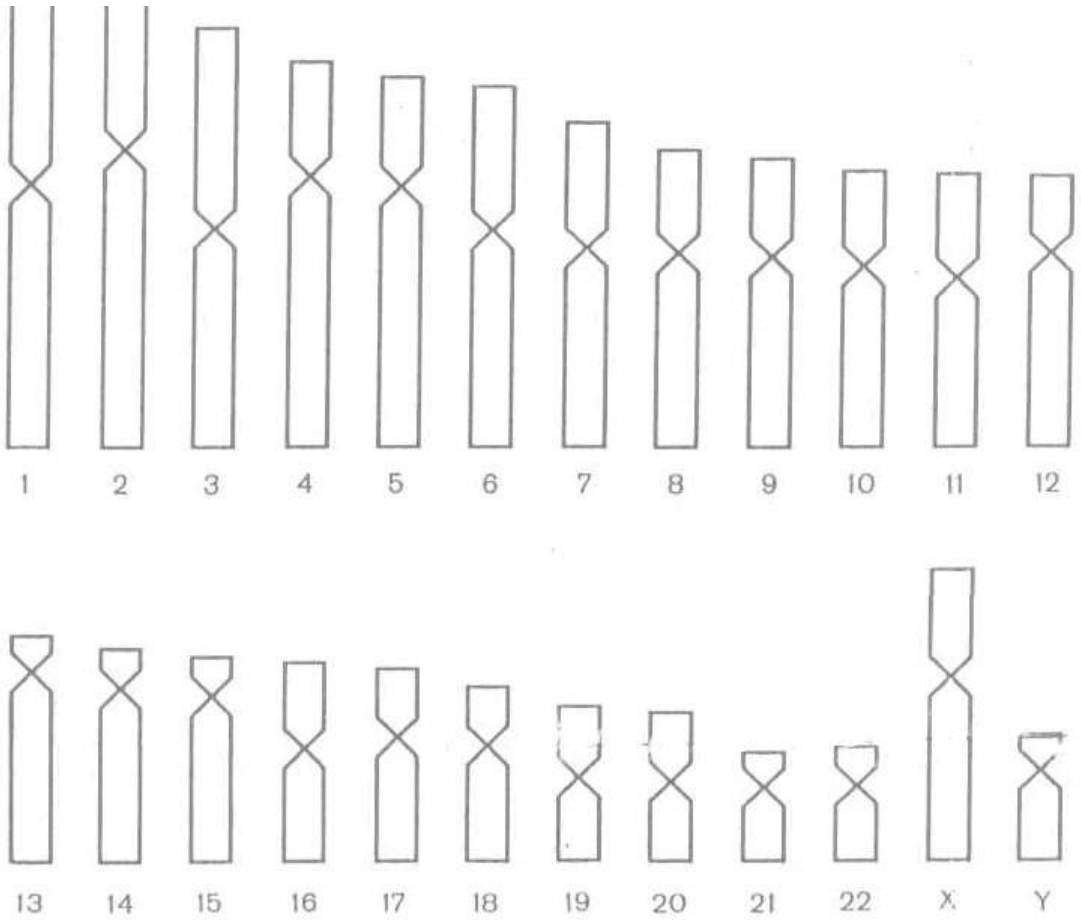
	1- 2- 3- 4-
Fig. 1. Metaphase Chromosome	

2.2. In the diagram, indicate the position of the centromere characteristic of the corresponding type of chromosome.

Fig.2. Main Types of Human Chromosomes

2.3.Study the identification scheme of human chromosomes in accordance with their size and centromere position.

Denver Classification



3. Genomic Level of Hereditary Material Organization .

3.1. Metaphase plates of human lymphocyte culture. Demonstration.

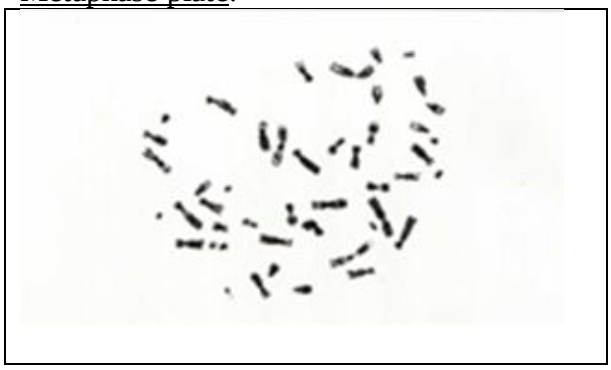
Study a micro-preparation of metaphase plates of a human lymphocyte culture (Mag. 7x90).

Pay attention to differences in the size and shape of chromosomes.

3.2. Identification of chromosomes in a human karyotype.

From the proposed set of chromosomes, compose an idiogram in accordance with the Denver (1960) and Paris (1972) classifications. Label groups, number pairs of homologous chromosomes and enter the characteristics of the chromosomes of each group.

Metaphase plate:



Chromosomes Idiogram:

<table>
<tr><td colspan="3">A</td><td colspan="4">B</td></tr>
<tr><td colspan="3">1 2 3</td><td colspan="4">4 5</td></tr>
<tr><td colspan="7">C</td></tr>
<tr><td colspan="7">6 7 8 9 10 11 12</td></tr>
<tr><td colspan="3">D</td><td colspan="4">E</td></tr>
<tr><td colspan="3">13 14 15</td><td colspan="4">16 17 18</td></tr>
<tr><td colspan="3">F</td><td colspan="2">G</td><td colspan="2">Sex chromosomes</td></tr>
<tr><td colspan="3">19 20</td><td colspan="2">21 22</td><td>X</td><td>Y</td></tr>
</table>

NECESSARY SKILLS:

1. Differentiation of human chromosomes according to their structure.
2. To make an idiogram of human somatic cell karyotype in accordance with Denver classification.
3. To finde quantitative and structural abnormalities of autosomes and heterochromosomes in the karyotype.

Student_____Teacher _____

LESSON 6

« ___» _____202___

THEME: Cell Reproduction. Gametogenesis.
AIM: to study the main biological property of the living- self-reproduction; somatic cell division types: amitosis and mitosis; meiosis in the gametogenesis; structure of gametes.

INDEPENDENT WORK:

1. Reproduction modes and forms.
2. Biological significance of cell division, division types.
3. Mitotic cell cycle, its biological significance.
4. Meiosis, its cytogenetic feature and biological significance.
5. Crossing – over, meaning.
6. Gametogenesis, phases.
7. Difference between spermatogenesis and ovogenesis.
8. Ovum and sperm structure. Ovum types.

INDEPENDENT WORK:

1. Write and Learn Basic Definitions:

Acrosome-

Amitosis-

Anaphase-

Apoptosis-

Crossing over-

Cytokinesis-

Endomitosis-

Equational division-

Fertilization-

Gamete-

Gametogenesis-

Gametogony-

Hyaluronidase-

Interphase-

Interkinesis-

Meiosis-

Metaphase-

Mitosis-

Mitotic cycle-

Ovocyte-

Ovogenesis-

Ovogony-

Ovum-

Prophase-

Reduction division-

Reproduction-

Somatic cell-

Spermatogenesis-

Spermatogony-

Spermatocyte-

Telophase-

2. Meiosis. Prophase I. Characteristic Features .

Give a brief description of chromosomes in each stage of meiosis prophase I.

1. **Leptotene –** _____
_____
_____

2. **Zygotene** – _____
_____
_____

3. **Pachytene –** _____
_____
_____

4. **Diplotene –** _____
_____
_____

5. **Diakinesis –**_____
_____
_____

6. **Dictyotene –** _____
_____
_____

CLASSWORK:

1. Reproduction of Somatic Cells.

1.1. Amitosis of somatic cells.

With mag. 7x40 study amitotic division of bladder cells in a mammal.

1.2. Mitosis of plant cells.

With mag. 7x40 study phases of mitotic cell division of onion root cells on permanent preparations. Pay attention to the position of chromosomes at different phases of the mitotic cycle of the cell.

2. Gametes and Gametogenesis.

2.1. Study the gametogenesis scheme using the Table. Fill in the Table, indicate periods of gametogenesis, type of cell division, cell names at various stages of gamete development, number of chromosomes (n) and DNA (chromatid) (c).

2.2. <u>Gametogenesis. Spermatogenesis and Ovogenesis Distinctive Features.</u>

Period of gametogenesis	**Spermato genesis (scheme)**	**Ovogenesi s (scheme)**	**Type of division**	**Stage of Gamete Development**	**Chromosome (n) and DNA (c) set**
1.Reproduction					
2.Growth					
3.Maturation	Division I -				

	Division II-				
4.Formation					

2.3. Meiosis
Using the tables study the meiotic division scheme; pay attention to the behavior of chromosomes in prophase I and analyze the crossing-over phenomenon and its biological significance.

2.4. Ovum structure. Ovogenesis
Using mag. 7x40 study a section of the ovary of a mammal, pay attention to the developing egg. Draw "Graaf bubble." Mark its parts.

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

Fig. 2. Graaf Bubble in the Ovary of a Mammal.

2.5. Sperm structure
With mag. 7x90 study permanent micro-preparation of human sperm and sketch the head, neck and tail.

1-
2-
3-

Fig. 3. Human Sperm. Mag. 7x90.

NECESSARY SKILLS:
1.To analyze mitotic phases in somatic cell .
2.To determine human gametes by structure.

Student_____Teacher _____

PART II "GENETICS"
LESSON №7

« ___» _____202___

THEME: Patterns of Monogenic Inheritance of traits in Humans.
AIM: to study the basic concepts and terms of genetics; to study the basic laws of monogenic inheritance of traits in humans; to define the following concepts: autosomal dominant, autosomal recessive and X- and Y-linked inheritance; to solve problems .
INDEPENDENT WORK:

1. Mechanisms of inheritance of monogenic (Mendel) traits.
2. Types of monogenic inheritance: autosomal dominant (AD) and autosomal recessive (AR).
3. Linked inheritance.
4. Inheritance linked to sex chromosomes.
5. Differentiation of the types of inheritance of traits (diseases) in humans.
6. Quantitative and qualitative genetic manifestations of traits (expressiveness, penetrance, pleiotropy).
7. Forms of interaction of allelic genes.

INDEPENDENT WORK:
1.Write and Learn Basic Definitions .
Autosomal dominant inheritance (AD) –

Autosomal recessive inheritance (AR) –

Incomplete Dominance –

Complete Dominance –

Genetic Mapping-

Mendelian Characters –

Penetrance –

Gene linkage (Genetic linkage) -

Linked inheritance –

Morgan unit-

X-linked inheritance –

Y-linked inheritance –

Expressiveness –

CLASSWORK :

1. G. Mendel Characteristics Inheritance.

1.1. Patterns of Mendelian traits inheritance .

Study the patterns of Mendelian traits inheritance . Analyzing crossing (test- crossing). Hypothesis of “gametes purity".

1.2. Solve Problems .

2. Monogenic Mode of Inheritance of traits in Humans.

2.1. Study autosomal dominant, autosomal recessive and X-linked types of inheritance of traits in humans.

2.2. Study and write down individual anthroposcopic Mendelian traits mode of inheritance of traits.

Human genetic trait	Phenotype and genotype				Type of inheritance	Types of possible genotype
	Trait	Gene	trait	Gene		
Eye size	big	A	small	A		
Eye incision	straight	B	slanting	B		
Eye color	brown	C	blue	C		
Visual acuity	myopia	D	normal	D		
Dimples	yes	E	no	E		
Ears	big	F	normal	F		
The gap between the incisors	yes	G	no	G		
Eyebrows	shaggy	H	normal	H		
Flexible tongue	yes	I	no	I		
Color of the skin	light	J	dark	J		
Freckles	yes	K	no	K		
Earlobe	loose	L	adherent	L		

2.3. Calculate and write down the sick and healthy children birth probability (%) depending on the genotypes of their parents. Fill in the Chart.

Genotypes of the parents		**AD type**		**AR type**	
		sick children	**healthy children**	**healthy children**	**sick children**
		AA; Aa	aa	AA;Aa	aa
Father	Mother				
AA	AA				
AA	Aa				
AA	aa				
Aa	AA				
Aa	Aa				
Aa	aa				
Aa	AA				
Aa	Aa				
Aa	aa				

Genotypes of parents		**X-linked dominant Inheritance**				**X-linked recessive inheritance**			
		sons		**Daughters**		**sons**		**daughters**	
		sick	**healthy**	**sick**	**Healthy**	**sick**	**healthy**	**sick**	**healthy**
		X^AY	X^aY	X^AX^A X^AX^a	X^aX^a	X^aY	X^AY	X^aX^a	X^AX^A X^AX^a
Father	Mother								
X^AY	X^AX^A								
X^AY	X^AX^a								
X^AY	X^aX^a								
X^aY	X^AX^A								
X^aY	X^AX^a								
X^aY	X^aX^a								
X^AY	X^AX^A								
X^AY	X^AX^a								
X^AY	X^aX^a								

NECESSARY SKILLS:

1. Solving problems with different types of inheritance.
2. Defining the probability of birth of sick and healthy children.

Student_____ Teacher _____

LESSON №8

« ___» _____202___

THEME: Inheritance of Blood Groups of the AB0 and Rh Systems in Humans.

AIM: to study the phenomenon of multiple alleleism in the inheritance of blood groups of AB0 systems in humans; Rh factor (Rh) inheritance.

INDEPENDENT WORK:

1. Phenomenon of multiple alleleism. Co-dominance.
2. Genetic and phenotypic characteristics of human blood groups of the AB0, Rh systems.
3. Genetic mechanisms of inheritance of human blood groups of systems AB0, Rh.
4. Genetic dependence of Rh incompatibility and Rh-conflict.
5. Genotypic and phenotypic blood transfusions dependence in medicine.

1. INDEPENDENT WORK:

Write and Learn Basic Definitions .

Agglutinogen-

Agglutinin –

Agglutination reaction –

Antibodies –

Co-dominance

Hemotransfusion –

Donor –

Multiple alleles-

Rhesus conflict –

Rhesus incompatibility –

Rh factor –

Recipient –

CLASSWORK :

1. Multiple Alleles.

1.1. Genotypic and phenotypic characteristics of the human blood groups of the ABO system. Study the mechanisms of inheritance of 4 human blood groups, their genotypic and phenotypic characteristics. Fill in the Table with possible genotypes and phenotypes of ABO blood groups.

Genotype and Phenotype Characteristics of the Human Blood Groups of the ABO System.

Blood group	Possible genotype	Phenotype	
		Antigens i in red blood cells	Antibodies in blood serum

1.2. Definition of the blood group for donated blood .

Using standard agglutinating serum of ABO system determine the blood group.

1.3. Arrows indicate possible (genetically determined) alternatives of donated blood transfusions.

II(A)

I(O) **IV(AB)**

III(B)

1.4. Mechanisms of inheritance of ABO blood groups.

Solve Problem. Identify and write possible genotypes of parents and alternatives of possible phenotypes and genotypes in their children.

Blood group of father and mother	Possible genotypes of parents	Possible genotypes of children	Blood groups of children
0 (I) x 0 (I)			
0 (I) x A (II)			
0 (I) x B (III)			
0 (I) x AB (IV)			
A (II) x B (III)			
A (II) x AB (IV)			
B (III) x AB (IV)			
AB (IV) x AB (IV)			

2. Blood Groups of the Rh System.

2.1. Genotypic and phenotypic characteristics of human blood groups of the Rh system.
Study genetic mechanisms of inheritance of the Rh factor in humans. Write in the table the possible genotypes and phenotypes of the blood types of the Rh system.

Blood Group	**Possible Genotypes**	**Phenotype**	
		red blood cells	**blood serum**
Rh (+)			
Rh (-)			

2.2. Arrows indicate possible Rh-factor alternatives of blood transfusions from donor to recipient.

Donor Rh (+) Recipient Rh (-)

Recipient Rh (+) Donor Rh (-)

2.3. The mechanisms of the Rh-factor inheritance and Rh-conflict. Write down genotypes of the parents and possible phenotypes and genotypes of their future children in the Table.
Specify the options for the development of Rh-conflict.

Mother		**Father**		**Child**	**Rh-conflict**
Phenotype	**Genotype**	**Phenotype**	**Genotype**	**Possible phenotype and genotype**	
Rh(+)		Rh(+)			
Rh(+)		Rh(-)			
Rh(-)		Rh(+)			
Rh(-)		Rh(-)			

3. Solve problems.

NECESSARY SKILLS:

1. Determining the phenotypes of human blood groups.
2. Calculating the possibility of blood -groups inheritance by children according to AB0 and Rh system.

Student_____ Teacher _____

LESSON №9

« ___» _____202___

THEME: Polygenic Inheritance in Humans. Gene Interaction within the Genotype.

AIM: to study main forms of gene interaction in polygenic inheritance; to study genotype as an integral system; to use the knowledge of gene interaction while analyzing the heritability of normal and pathological conditions in humans.

INDEPENDENT WORK:

1. Polygenic inheritance in humans.
2. Mechanisms of inheritance of polygenic traits with various forms of gene interaction.
3. Modulation of the gene function by other genes. Dominant and recessive epistasis . Position effect.
4. Polygenic inheritance. Polymerism.

INDEPENDENT WORK:

1. Write and Learn Basic Definitions.

"Bombay Phenomenon"-

Genes -inhibitors or suppressors –

Complementary gene interaction -

Hypostatic gene-

Pleiotropy -

Polymerism-

Epistasis –

CLASSWORK:

1. Complementary Gene Interaction.

Study and write down in the album genetic mechanisms and phenotypic manifestations of the complementary gene interaction via the example of human inheritance of hearing.

Solve problem.

2. Epistatic Effect of Genes.

Study and write down in the album the genetic mechanisms and phenotypic effects of epistatic gene interaction via the example of the "Bombay phenomenon" in the inheritance of blood group in humans.

Solve problem.

3. Polymeric Gene Interaction.

4.1. Study and write down in the album genetic mechanisms and phenotypic polymorphism in the polymeric gene interaction via the example of the inheritance of skin pigmentation in humans. Write down the appropriate number of dominant and recessive genes when polymeric gene interaction leads to the formation of the corresponding skin color phenotype. Paint the columns of the picture in accordance with the color of the skin of a person.

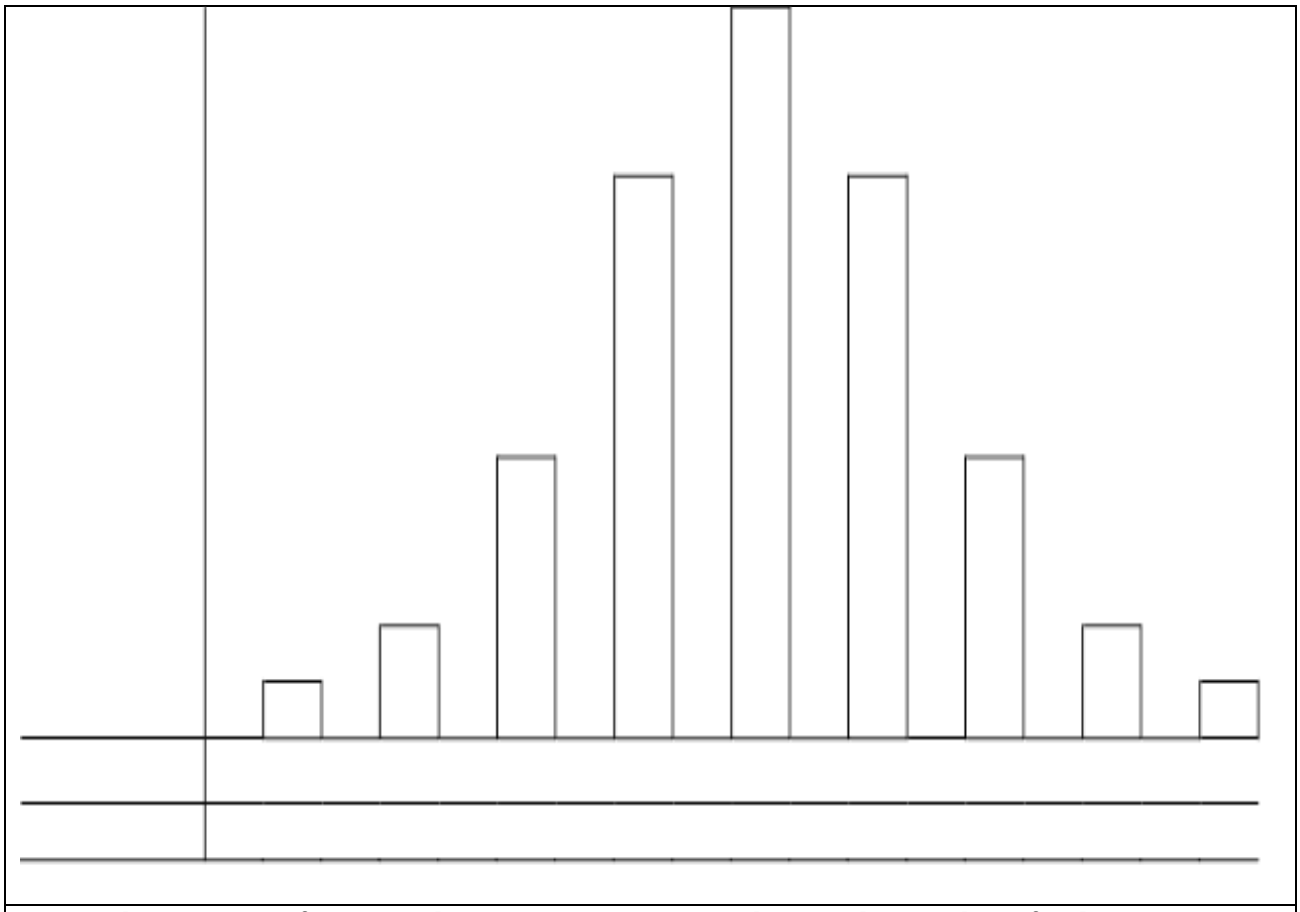


Fig 1. The Intensity of Human Skin Pigmentation Depending on the Number of Polymer Interacting Dominant and Recessive Genes

3.2. Solve the problem. Polymeric body height inheritance in humans .

4. What Form of Gene Interaction Causes the Following Symptoms?

Symptom	Gene interaction
1. Hemoglobin in an adult contains 4 polypeptide chains, each of which is encoded by separate independent genes (A, B, C, D).	
2. The production of interferon in humans depends on two pairs of genes located on chromosome 3 and 5.	
3. In a person suffering from phenylketonuria, phenylpyruvic acid is synthesized and the formation of melanin is blocked.	
4. The gene that determines the thin, long fingers (arachnodactyly) causes disruption of the development of connective tissue, pathology of an eye structure, as well as anomalies of the cardiovascular system.	

NECESSARY SKILLS:

1. To calculate the risk of manifestations of the signs of the disease in the family.

Student _____ Teacher _____

LESSON № 10

« ___» _____20 ___г.

THEME : Mutagenesis of the Hereditary Apparatus.

I: **AIM:** to study the classification of mutations of the hereditary apparatus, identification of types of chromosomal mutations in the human karyotype, to study the registration nomenclature of mutations.

INDEPENDENT WORK :

1.Mutations of hereditary material, significance in human nature and pathology.
2.Classification of mutations, mechanisms of mutation manifestation (consequences of phenotypic manifestation)
3.Mutagenesis factors.
4.Genome mutations, classification.
5.Chromosomal mutations, classification..
6.Gene mutations, mutation options and potential mechanisms.

INDEPENDENT WORK:

1.Write and Learn Basic Definitions .

Aneuploidy (heteroploidy) –

Chromosome aberration –

Chromosomal mosaicism-

Haploidy –

Deletion –

Duplication –

Gamete mutation –

Gene mutation-

Genome mutation – Inversion -

Monosomy –

Mutagen -

Paracentric inversion –

Pericentric inversion -

Somatic mutation –

Polyploidy –

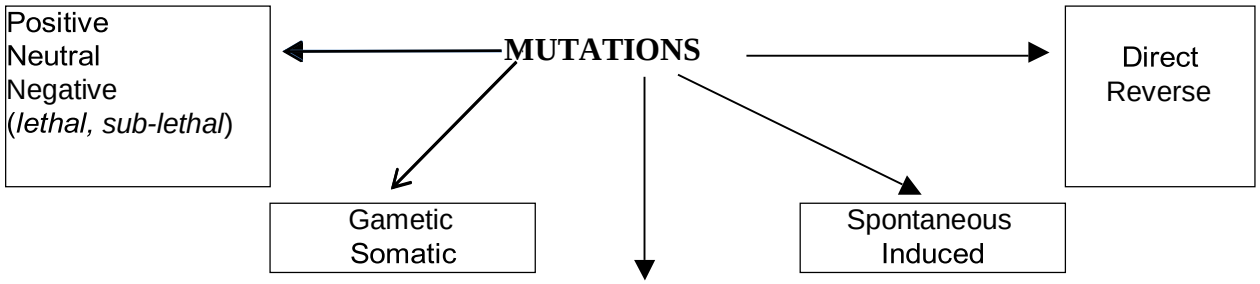
Translocation –

Trisomy –

CLASSWORK:

1. Classification of Mutations of the Hereditary Apparatus. Study classification of mutations of the hereditary apparatus.

Classification of Mutations of Hereditary Material



Genomic	Chromosomal		Gene	
1.Mosaicism	**Interchromosomal**	**Intrachromosomal**	**Monogenic**	**Polyge**
2.Polyploidy:	1.Translocation:	1.Inversion	Structural Regulatory	
a) autoploidy	*a) Robertsonian*	*a) pericentric*	1.Point mutations:	
b) alloploidy	*b)reciprocal and*	*b) paracentric*	*a) nonsense*	
3.Haploidy	*nonreciprocal*	2.Duplication	*b)missense*	
4.Heteroploidy	*c)balanced and*	3.Deprivation:	*c)silent*	
(aneuploidy):	*unbalanced*	*a) deletion*	1.Deletion	
a) monosomy		*b) deficiency*	2.Insertion	
b)trisomy		4. Fragmentation	3.Inversion	
c)polysomy				

2. Genomic Mutations. Chromosomal Aneuploidy.

Analyze karyograms of the person with the abnormal number of autosomes and sex chromosomes. Identify changes in the karyotype of the person and possible mutation mechanism. Write down the explanations of the chromosomal aneuploidy:

45,X - _____

47,XXY - _____

45,XX,G - _____

48,XXY,G+ - _____

47,XY,18+ - _____

46,XY,18+,21 - _____

47,XX,13+ _____

45,X/46,XX/47,XXX - _____

3. Chromosome Mutations (Aberrations)

3.1. Write the nomenclature of structural changes in chromosomes:

p - _____

q - _____

p+ or q+ - _____

p- or q- - _____

s - _____

h- _____

i - _____

r- _____

t- _____

inv- _____

(p+q-) or (p-q+) - _____
_____

3.2. Analyze personal human karyograms and slides with chromosomal rearrangements. Sketch the types of chromosomal rearrangements.

a)Deprivation:

deletion -

b)Inversion:

paracentric –

pericentric -

c)Duplication -

d)Translocation:

reciprocal –

nonreciprocal –

4. Gene Mutations.

Analyze the options of gene mutations and write possible mutation mechanisms.

I. Frame-shift mutations:

a)_____

b)_____

II. Non-frameshift mutations:

a)_____

b)_____

NECESSARY SKILLS:

1. To identify the karyotypes of the patients using the mutation registration nomenclature.

2. To identify the type of genomic and chromosomal mutation in the ideogram of human chromosomes.

Student_____Teacher _____

LESSON № 11

« ___» _____ 20 ___г.

THEME: Gene Diseases in Humans. Diagnostic Methods for Hereditary Diseases (Biochemical, Genealogical, Molecular Genetic).

AIM: to study the classification of human hereditary diseases caused by gene mutations; to learn how to make pedigree charts, to define principles of biochemical and molecular genetic diagnosis of human hereditary diseases; to learn how to draw and analyze pedigree charts of the families with hereditary pathology, to define the mode of inheritance, genotypes of the family members, to predict the risk of the manifestation of the disease within generations.

INDEPENDENT WORK:

1. Hereditary metabolic diseases. Classification.
2. The purpose and principle of biochemical, genealogical and molecular genetic methods of diagnosis of hereditary diseases.
3. Pedigree symbols.
4. Principles and rules to make and analyze pedigree charts with different modes of inheritance.
5. The modes of inheritance of normal and pathological conditions in humans. The methodical approach to the assessment of the mode of inheritance of human gene pathology.
6. Phenotypic characteristics of syndromes associated with gene mutations: PKU, cystic fibrosis, hypothyroidism, achondroplasia, Marfan syndrome, hemophilia.

INDEPENDENT WORK:

1.Write and Learn Basic definitions .

Chromatography –

Electrophoresis of amino acids –

Fluorometry –

Pedigree chart –

Genealogy –

Guthrie test –

Half sibs –

Inbred marriage –

Incest marriage –

Intersex –

Proband –

Sibs –

Sequencing of genomic DNA –

Twins –

CLASSWORK:

1. Human Gene Diseases.

Study the classification of hereditary metabolic diseases in humans, caused by mutations of dominant and recessive genes localized in autosomes and sex chromosomes. Fill in the Chart.

.

Pathologic metabolism	*Disease*	*Mode of inheritance*
Amino-acid		
Lipid		
Carbohydrate		
Connective tissue		
Transport systems		
Hormones and their transport		
Metals		

2. Diagnostic Methods for Genetic Disorders in Humans.

2.1. Biochemical method.

Analyze the purpose and the principle of biochemical method of diagnosis of hereditary metabolic diseases.

2.1.1. The diagnosis of phenylketonuria (PKU).

Analyze and write down the main stages of modern PKU diagnostic methods: amino acid analysis (electrophoresis, fluorometry, chromatography).

Electrophoresis:

1)_____

2)_____

3)_____

Fluorometry:

1)_____

2)_____

3)_____

Chromatography:

1)_____

2)_____

3)_____

2.2. Genealogical method.

2.2.1. Genetic symbols.

Analyze and write down the symbols used in the human pedigree chart.

- female
- male
- marriage
- consanguineous marriage
- remarriage
- extra-marital relationship
- sibs
- half sibs
- monozygotic twins
- proband
- intersex
- gender unknown
- child with disfiguration
- stillbirth (abortion)
- normal phenotype
- carrier of a recessive trait
- died in childhood
- dizygotic twins

2.2.2. How to make pedigrees.

Make the pedigree chart of your family using pedigree symbols.

2.2.3. Genealogical analysis.

2.2.3.1. List and explain the stages of genealogical analysis:

1 stage - …….

2 stage - …….

3 stage - ……..

2.2.3.2. Analyze the pedigree chart of your family.

2.2.4. Make pedigrees with different modes of inheritance. Analyze pedigree charts with different modes of inheritance.
a) autosomal dominant:

b) autosomal recessive:

c) X-linked recessive:

2.3. Molecular genetic method of hereditary diseases diagnosis.
2.3.1. Study principles and methodological approaches to studying human DNA polymorphism under normal conditions and in case of hereditary diseases.
2.3.2. Analyze basic methods of DNA diagnosis. Write down the principle of the method in the Chart.

Basic Methods of DNA Diagnostics:

	Principle of the method
PolymerasChain Reaction	
DNA Sequencing	

2.3.3. Assess significance of the method in prenatal diagnosis and in case of phenotypic manifestation of pathological genes. Write down the sequence of the main stages of the polymerase chain reaction.

Basic Stages of the Polymerase Chain Reaction:

1. DNA extraction –

2. Amplification:

a) DNA denaturation –

b) Annealing –

c) Elongation-

3. Detection of Results –

NECESSARY SKILLS:

1. To collect information about the proband pedigrees.
2. To make pedigrees.
3. To analyze pedigrees.

Student _____Teacher _____

LESSON № 12

« ____» _____20____ г.

THEME: Cytogenetic Method in the Chromosome Pathology Diagnosis. Human Chromosome Diseases.

AIM: to study methods of cytogenetic analysis, cytogenetic and phenotypic classification of human chromosome diseases.

INDEPENDENT WORK:

1. Purpose and principle of cytogenetic research; its application in medicine.
2. Sex chromatin, its nature and diagnostic possibilities.
3. Principles of classification of human chromosomes.
4. Chromosome diseases, cause, classification.
5. Main phenotypic traits of chromosome syndromes.

INDEPENDENT WORK:

1.Write and Learn Basic Definitions .

Buccal epithelium -

Chromosomal mosaicism –

Barr body-

X-chromatin –

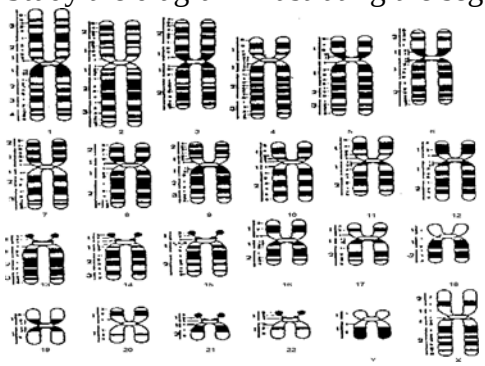
Y-chromatin –

CLASSWORK:

1. Methods of Cytogenetic Analysis in Human Chromosome Diseases Diagnosis.

1.1. Analysis of human karyotypes.

Study the diagram illustrating the segmentation of human chromosomes with differential staining.



1.2. Analysis of human karyotypes with an abnormal number of chromosomes.

Study and analyze the human personal karyograms. Pay attention to the groups of chromosomes with a modified number. Write the karyotype and correct diagnosis.

Karyogram 1

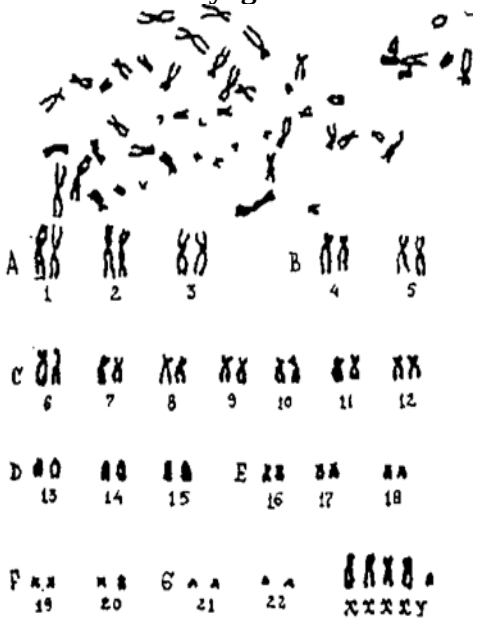
Karyogram 2

Karyotype _____ Karyotype _____

Diagnosis_____ Diagnosis_____

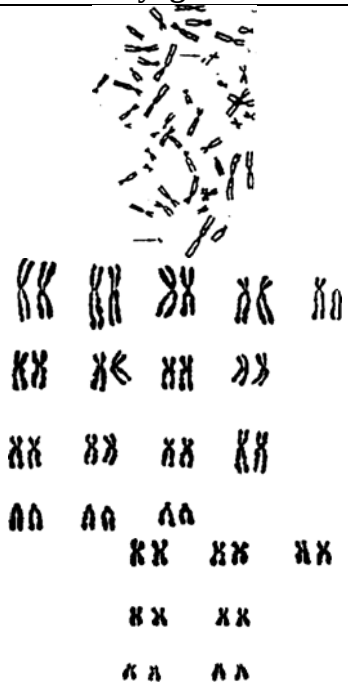
Karyogram 3

Karyogram 4



Karyotype _____ Karyotype _____
Diagnosis_____ Diagnosis_____

1.3.Analysis of human karyotypes with chromosome aberrations.
Study the human karyotypes with chromosome rearrangements. Learn the type of chromosome aberration. Write the cytogenetic nomenclature and phenotypic characteristics of the pathology.

Karyogram 5	**Karyogram 6**
	
Karyotype _____	Karyotype _____
Diagnosis_____	Diagnosis_____

1.4. Scheme of non-disjunction of X chromosomes in gametogenesis.
Sketch the scheme of the X chromosome disjunction abnormality in gametogenesis as the mechanism of some human chromosome diseases.
1.5.Research method for X-chromatin.
Study X-chromatin in human cells in accordance with Sanderson method. Prepare a temporary preparation of human buccal epithelium and examine it with magnification 7x90 (immersion system). Calculate the percentage of chromatin-positive nucleus in 100 cells. Write possible options of karyotypes corresponding to the number of X-chromatin clumps in the cell nucleus.

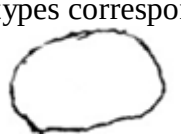


Fig.1. Possible karyotypes_____
_____

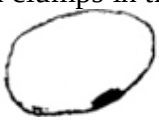


Fig.2. Possible karyotypes_____
_____

Fig.3. Possible karyotypes_____
_____

Fig.4. Possible karyotypes_____
_____

2. Human Chromosomal Disorders.
2.1. Classification of human chromosome disorders.
Analyze etiology and development mechanisms of human chromosome pathology. Study classification of chromosomal disorders.

CLASSIFICATION OF CHROMOSOME DISORDERS (SYNDROMES)

Change in chromosome number (genome mutations)	Changes in chromosome structure (chromosome mutations)
1.Polysomy of autosomes: trisomy 13 (Patau syndrome) 47,XX(XY),13+ trisomy 18 (Edwards syndrome) 47,XX(XY),18+ trisomy 21 (Down syndrome) 47,XX(XY),21+ **2.Polysomy of sex chromosomes:** Kleinfelter syndrome 47,XXY; 48,XXXY trisomy X syndrome 47,XXX tetrasomy X syndrome 48,XXXX pentasomy X syndrome 49,XXXXX disomy Y syndrome 47,XYY polysomy Y syndrome 48,XYYY **3.Monosomy** Turner syndrome (monosomy X) 45,X **4.Chromosome mosaicism:** Down syndrome, mosaic type 46,XY/47,XY,21+ Turner syndrome, mosaic type 45,X/46,XX	**1.Aberrations of autosomes:** deletion of the short arm of chromosome 4 (Wolf–Hirschhorn syndrome) 46,XX(XY),4p- deletion of the short arm of chromosome 5 (Cri du chat (cat's cry) syndrome) 46,XX(XY),5p- translocation of 21 autosome by 15 (Down syndrome, translocation form) 46,XX(XY),t(15/21)+ **2. Aberrations and mosaicism of sex chromosomes:** Duplication of part of the long arm of X chromosome 46,X,dup(X) (q12->q26) Translocation X/X 46,X;t(X/X) (q ter->p11::q22->q ter) Dicentric Y chromosome and mosaicism 45,X/46,XY, dicY The structural changes of sex chromosomes cause gonadal dysgenesis syndrome.

2.2.Fill in the Chart indicating cytogenetic and phenotypic characteristics of human chromosome diseases.

Chromosome syndromes	Karyotype	Number of X chromatin bodies	Phenotype
Turner			
Kleinefelter			
Trisomy X			
Polysomy Y			
Down			
Patau			
Edwards			
Wolf– Hirschhorn			
Cri du chat (cat's cry)			

NECESSARY SKILLS:

1. To make a research on the X-chromatin in humans.
2. To analyze karyotypes of patients with chromosome diseases.
3. To finde out the type of genome or chromosome mutations using microscopy, photographs of idiograms and metaphase plates.

Student _____ Teacher _____

LESSON № 13

« _____» _____20 ____г.

THEME: Gene Pool of the Population, Study Methods (Population- Statistical Method and Twin Method). Human Populations. Factors of Population Dynamics. Principles of Genetic Counseling.

AIM: To use the Hardy-Weinberg equation for calculation of the gene frequency of personal attributes in populations; to study methodological methods for evaluating the genetic load of a population; to study possibilities of the twin method in population genetic analysis. To study demographic and genetic factors affecting the structure of human populations; calculate the inbreeding coefficient in a "consanguineous" marriage; methodologically assess the genetic structure of a population and the size of a genetic load. To learn the principles of genetic counseling.

INDEPENDENT WORK:

1. Concepts: gene pool and genetic load of populations.
2. Methods for calculating the genetic load of a population. The aim and subject of Hardy-Weinberg's law.
3. The phenomenon of twoness in human populations.
4. The twin method used in differential diagnostics of hereditary human diseases.
5. Concepts: population, human populations, demos, isolates; gene pool and genetic burden of the population.
6. Genetic and demographic factors of population dynamics. The main factors in the dynamics of the gene pool of human populations: migration, inbreeding, isolation, gene drift, mutation process, natural selection; methods for assessing their impact on the structure of populations.
7. The inbreeding coefficient, its meaning and calculation in the family under investigation.
8. Problems and principles of medical genetic counseling. Genetic counseling in chromosome and gene pathology.

INDEPENDENT WORK:

1.Write and Learn Basic Definitions :

Twins-

Dizygotic twins-

Monozygotic twins-

Gene pool-

Genetic burden-

Twins Discordance-

Gene drift-

Twins Concordance-

Inbreeding rate-

Human population-

CLASSWORK:

1. Gene Pool of the Population.

1.1. Calculation of gene frequencies in a population.

Calculate frequency of recessive and dominant genes in populations using Hardy- Weinberg equation. Solve problems.

1.2. Assessment of the genetic burden of a population.

Based on certain frequencies of pathological dominant and recessive genes, evaluate the burden of hereditary pathology in the population.

2. Study the Genetic and Demographic "Portrait" of the Population.

Marriage type and pedigree	**A**	**B**	**C**	**n**	**Inbreeding coefficient**	
					$F=A(1/2)^{B+C}$	$F=\sum(1/2)^{n-1}$
Between father and daughter						
Between siblings						
Between half-siblings						
Between uncle and niece						

2.Genetic "Portait of the Population. Main Factors.

2.1. Demographic factors that determine the structure of the population, population size, age and gender and ethnic composition, migration, marriage structure, vital characteristics.

2.2. Genetic factors of the population: gene drift, mutation process, natural selection, inbreeding coefficient, mating migration (endogamy index, gamete index).

2.3. The inbreeding coefficient.

Calculate the inbreeding coefficient in families with consanguineous marriages.

NOTE:

A - ……..…….…….……

B - ……...…….…….

C - …….

n - …….…….

3. Twoness in Human Populations

3.1. Identification of twins

Study phenotypic and anthroposcopic traits used for identification of twins. Write down the missing traits of concordance and discordance of monozygotic (MZ) and dizygotic (DZ) twins.

Trait	**Concordance (%)**		**Discordance**	
	MT	DT	MT	DT
Blood type	100			36
Eye color	86,5	28		
Hair color	75			77
Skin color		35	13	
Eyebrows	98	51		
Nose shape		30	15	
Lip shape	85			35
Ear shape			23	80

3.2. The Ttwin Method in population studies. Solve problems.

Calculate the dominant factor (genetic or environmental) affecting the abnormality in humans using the Holzinger formula. Write the coefficient of heritability of the analyzed abnormality and make the conclusion concerning the factor affecting the abnormality (pathology).

Abnormality (pathology)	C_{MZ}	C_{DZ}	$H = \frac{C_{mz} - C_{dz}}{100\% - Cdz}$	Conclusion

4. The Basics of Genetic Counseling of the Population.

4.1. Study the tasks and methods of medical and genetic counseling of patients with chromosome and gene pathology. Study the structure of medical genetic counceling in healthcare.

4.2. Genetic counseling for chromosomal pathology.

Study phenotypic (clinical) pathology of patients with chromosome pathology presented on photographs and slides. Assess the family situation and possibilities of genetic counseling.

4.3. Genetic counseling.

Study phenotypic (clinical) pathology in patients with monogenic pathology of various types of inheritance (AD, AR, X-linked) presented on photographs and slides.

NECESSARY SKILLS :

1. To calculate alleles frequency using Hardy-Weinberg method.
2. To determine the main factor (hereditary or environmental) in the pathogeny of the human disorder.
3. To calculate indices of marriage migrations (endogamy index, gamete index).
4. To make genealogical register of the studied population.

Student_____ Teacher _____

LESSON № 14

«_____»_____20___г.

THEME: Method of Dermatoglyphics in Medicine.

AIM: Study the method of dermatoglyphics, its application in the diagnostics of human chromosomal and gene pathology; analyze palmar dermatoglyphs in normal condition and with human hereditary pathology.

INDEPENDENT WORK :

1. The purpose and principles of dermatoglyphics method.
2. Morphological features of skin ridge.
3. The basic principles of dermatoglyphics analysis.
4. Dermatoglyphic properties in human hereditary diseases.
5. Variability of dermatoglyphic indices in hereditary pathology.

INDEPENDENT WORK:

1.Write and Learn Basic Definitions .

Hypotenar –

The ridge count -

Dermatoglyphics-

Dactyloscopy -

Palmoscopy –

Plantoscopy-

Tenar –

The delta point -

Triradius-

CLASSWORK:

1. Genetic Mechanisms of Skin Pattern Inheritance.

Analyze the genetic basis of the inheritance of skin pattern of the palms and fingers in humans.

2. Make and Analyze Dermatoglyphic Prints of the Person .

2.1. Study and use the method of obtaining human dermatoglyphic prints.

2.2. According to the charts study, sketch and write down the main qualitative and quantitative characters of fingerprinting and palmoscopy.

Qualitative Characteristics - Skin Patterns of Fingerprints:

Arch	Radial loop	Ulnar loop	Whorl

2.3. Make prints of papillary patterns of both palms fingers.

Dermatoglyph of the Left Palm

V	IV	III	II	I

Dermatoglyph of the Right Palm

V	IV	III	II	I

2.4Analysis of palmar dermatoglyphs

Analyze the distribution of fingerprint signs on the obtained prints (type of finger pattern and ridge count). Analyze the distribution of palmoscopic traits on dermatoglyphs (the number of triradius on the palms, the size of the palmar angles, the distance between triradiuses a, b, c, d). Fill in the Chart, make the conclusion.

Right hand						**Left hand**					
Finger	1	2	3	4	5	Finger	1	2	3	4	5
Pattern						Pattern					
Ridge count						Ridge count					
Angle						Angle					

NECESSARY SKILLS:

1.To determine the type of inheritance of a trait (disease) in the pedigree.
2.To define a human genotype in pedigrees .
3.To calculate the risk of birth of a sick child with the hereditary disorder.
4.To calculate the inbreeding coefficient in a consanguineos marriage.
5.To make a dermatoglyphic imprint.
6.To analyze the dermatoglyphs of the finger pads , palms and feet (type of finger pattern, delta index, ridge count, location of palmar triradiuses, calculation of palmar angles, distance between palmar triradiuses, etc.

Student_____ Teacher _____

PART III "ONTOGENY"

«____»_____202__.

LESSON N15

THEME: Human Ontogeny, Ontogeny Periodization. Main Stages of the Embryogenesis. Critical Periods of the Ontogeny. Congenital Malformations in Humans.

AIM: To analyze the periods of human ontogeny. To study the general patterns of embryogenesis considering the critical periods and the possible effect of teratogenic factors that determine congenital malformations.

INDEPENDENT WORK.

1.Ontogeny concept, types of the ontogeny. Periodization of the ontogeny.
2.Morphological and evolutionary features of the ova in Chordates.
3.Characteristics and significance of the main stages of embryogenesis: fragmentation, gastrulation, differentiation of germ layers, histo-organogenesis.
4.The embryonic provisory organs of Vertebrates, their significance.
5.The role of disturbances of the ontogeny mechanisms in human pathology. Critical periods in the human ontogeny.
6.Teratogenesis. Teratogenic factors.
7.Congenital malformations in the human ontogeny, CM classification.

BASIC DEFINITIONS :

Agenesia-

Amnion –

Amniotes –

Anamnia –

Atresia –

Heterotopia –

Hypoplasia –

Dermatome –

Critical periods of ontogeny -

Myotome –

Ontogeny –

Placenta -

Stenosis –

Teratogen –

Totipotency –

Fetal period of embryogenesis –

Chorion –

Ectopia –

Embryonic period –

CLASSWORK
1. Ontogeny Periodization.
Specify the main stages of the human ontogeny. Write down their characteristics.

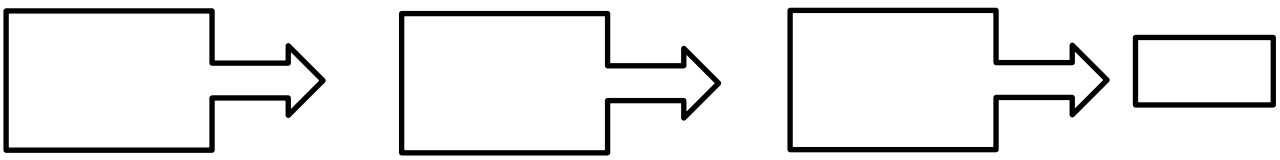


Fig. 1. The Ontogeny Periodization

2. Morphological and Biochemical Characteristics of the Ova in Chordates.

According to Fig. 2 determine and designate the ovum type of: alecital, isolecital, telolecital, centrolecital .

Pay attention to the correlation of the ovum structure with the type of an embryo cleavage.

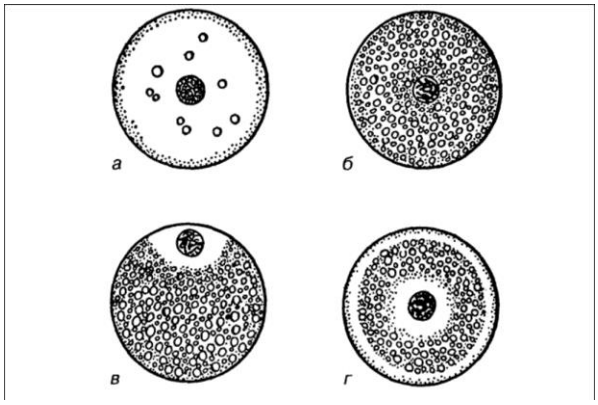


Figure 2. Ovum Types depending on the yolk quantity and its distribution.

3. Embryonic, or Prenatal Period

3.Gastrulation – formation 2- or 3- layer embryo

Modes of Forming a 2-layer Embryo	**Modes of Forming a 3-layer Embryo**
1.	1.
2.	
3.	2.
4.	

3.1. Primary organogenesis as a process of forming a complex of axial organs.

Analyze the structure of the embryo in the early stages of embryogenesis, designate the embryonic layers and axial organs.

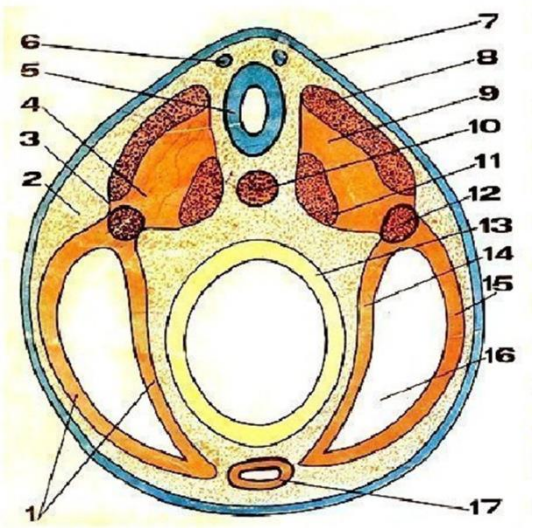


Fig 3. Scheme of the embryo structure in the early stages of embrygenesis.

3.2. Differentiation of germ layers, formation of organs and tissues.

Fill in the Chart the derivatives of germ layers in the process of embryogenesis.

Germ layer	**Organ system**
1. Ectoderm	
2. Mesoderm	
3. Endoderm	

4. Teratogenesis. Teratogenic Factors.

Study the classification of teratogenic factors. Write down the examples.

Physical_____

_____

Chemical_____

_____

Biological_____

_____

4.1. Classification of Congenital Malformations (CM).

Study the classification of congenital malformations and write their main characteristics in the Chart

Classification of Congenital Malformations

	CM	Feature
	By reason of	
1.	Genetic	
2.	Exogenous	
3.	Multifactorial	
	By time of occurrence	
1.	Gametopathy	
2.	Blastopathy	
3.	Embryopathy	
4.	Fetopathy	
	By extent of damage	
1.	Isolated	
2.	Systemic	
3.	Multiple	

NECESSARY SKILLS:

1.To identify the types of cleavage, modes of formation of two-, three-layer embryo.
2. To Justify the conditions affecting the development of CM in humans.
3. To determine the nature of possible CM in the embryo/fetus by the time of exposure to teratogenic factor in the embryonic period .
4. To solve situational problems.

Student _____ Teacher_____

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LESSON N16

THEME: Correlation of the Ontogeny and Evolution. Phylogeny of Skin and Skeleton. Genetic and Phylogenetic Provision of CM of the Skin and Skeleton in Humans.

AIM: to Study the phylogeny of the skin and skeleton in Vertebrates, genetic and phylogenetic provision of CM of the skin and skeleton.

INDEPENDENT WORK:

1. Human ontogeny and its relationship with the phylogeny of vertebrates.
2. Functions and structure of the skin in Vertebrates.
3. Possible reasons and forms of skin CM in humans.
4. Development of the internal axial skeleton in a row of Vertebrates.
5. Origin and transformation of the head skeleton in the phylogeny of Vertebrates.
6. Transformations in the structure of the human skeleton associated with upright posture.
7. Possible reasons and forms of CM in the human skeleton.

BASIC DEFINITIONS:

Abrachia-

Ahydria-

Anabolia-

Apodia-

Archalaxis-

Atavism-

Brachydactyly-

Hypertrichosis -

Deviation –

Oligodactyly-

Polydactyly-

Polymastia-

Polythelia-

Recapitulation –

Rudiments-

Syndactyly-

Synostosis-

Phyloembryogenesis-

Phocomelia -

Spina bifida-

CLASSWORK:

1. Phylogeny of the Skin in Vertebrates.

Study phylogenetic transformations of the skin and its derivatives.

Fill in the Chart by selecting the appropriate definitions at the bottom of the Chart.

Evolution of the skin and its derivatives in Vertebrates

Class Of the Vertebrates	**Skin Functions**	**Structure of the Epidermis**	**Derivatives of the Skin**	**Skin Glands**
Fishes				
Amphibians				
Reptiles				
Mammals				
Direction of evolution	Expanding the number of functions performed, strengthening of the main function	From single-layer cylindrical epithelium to stratified squamous; from non-keratinizing to keratinizing	Increasing the diversity skin appendages	Deepening in the dermis, specialization of the glands. From unicellular to multicellular structures

Skin functions

A. Protective, secretory, sensory, regulatory.
B. Gas Exchange- respiration , metabolism.
C. Thermoregulatory, excretory, protection from UV rays (melanin), synthetic

Structure of the Epidermis

A. Multilayer, low keratinizing. The transition from the growth layer to the keratinizing layer is gradual.
B. Multilayer, cylindrical, non-keratinized. Formed by living cells.
C. Multilayer, keratinizing, clear transition from the growth layer to keratinizing layer
D. Multilayer, keratinizing (keratohyalin) Change of the stratum corneum by shedding. The transition from the growth layer is gradual.

Derivatives of the Skin

A. Horn scales, shields, membranes, claws, shell.
B. Hair, vibrissae, scales, horns, hooves, nails, claws.
C. Scales (placoid and bony).
D. Thickening of the stratum corneum in the form of warts.

Skin Glands

A. Sebaceous, sweaty, milky, odorous, ceruminous.
B. Odorous (crocodiles, turtles).
C. Multicellular mucous membranes, poisonous.
D. Unicellular mucous, poisonous, chromatophores.

2. Congenital Malformations of the Skin and its Appendages in Humans.

Study some skin CM, considering the absence of distant ancestral recapitulation in the ontogeny of human skin.

3. Phylogeny of the Skeleton in Vertebrates.

3.1. Study phylogenetic changes in the structure of the Vertebrate skeleton. Fill in the Chart 2 main characteristics of the skeleton of representatives of different classes of Vertebrates.

Chart 2

Class	**Skeleton Type**	**Structural Features of a Trunk Region of the Axial Skeleton**
Fishes		
Amphibians		
Reptiles		

Birds		
Mammals		

4. CM of the Human Musculoskeletal System.

Using the slides, view various CM of the human skeleton. Sort out onto- and phylogenetic provision of CM. Pay attention to the fact that human embryogenesis recapitulates the main phylogenetic stages of the musculoskeletal system.

NECESSARY SKILLS:

1.To determine the main directions of evolution of the skin and skeleton of vertebrates with a comparative analysis of these systems.

2.To explain onto- and phylogenetic provision of defects of the skin and skeleton CM

3.To solve situational problems.

Student _____ Teacher_____

LESSON No 17

«____»_____202_

THEME: Phylogeny of the Digestive, Respiratory and Circulatory Systems in Vertebrates. Onto- and Phylogenetic Provision of the Congenital Malformations of the Digestive, Respiratory and Circulatory Systems.

AIM: To study the structural features of the digestive, respiratory and circulatory systems of Vertebrates; to specify the direction of evolution of these systems. To give a genetic and phylogenetic characteristics of the digestive, respiratory and circulatory systems CM in humans.

INDEPENDENT WORK:

1. Structure, functions and direction of evolution of the digestive system in Vertebrates:
   -embriogenesis and differentiation of the digestive tube into regions;
   - formation of the oral cavity, teeth; dental systems;
   - development of digestive glands and their significance.
2. Structure of the respiratory organs in animals related with the organization level and habitat.
3. The direction of evolution of the respiratory system in Vertebrates: the correlation of the respiratory and digestive systems in terrestrial Vertebrates, the genesis of pulmonary respiration as a major aromorphosis in the development of Vertebrates;
4. The main stages and directions of the evolution of the circulatory system in Vertebrates that determine the structure and function of the human circulatory system
   - the transition from a 2-chamber to a 4-chamber heart;
   - laying and transformation of I-VI pairs of arterial arcs;
   - transition to warm-bloodedness in birds and mammals.

BASIC DEFINITIONS:
Acardia -

Achalasia -

Botallo duct (arterial duct) –

Congenital cleft lip and palate -

Lateral cyst of the neck-

Macroglossia -

Macrodontia -

Microgenia -

Microdontia -

Microstomia -

Aortic stenosis-

Transposition of great arteries -

CLASSWORK:

1. Phylogeny of the Digestive System in Vertebrates.
Study the phylogenetic transformations of the digestive tract in Vertebrates: differentiation into regions, the development of food grabbing organs and food mechanical processing organs in the anterior part, the development of digestive glands.

1.1 .Draw and indicate the human dental formula.

-incisors
-canines
-premolars
-molars

Fig. 1. The Human Dental Formula.

2.Congenital Malformations of the Digestive System.
Study some CM of the digestive system; analyze their onto- and phylogenetic provision: atresia of the esophagus, duodenum, large intestine, anus; esophageal stenosis; pylorostenosis; tracheoesophageal fistulas, etc.

3.Phylogeny of the Respiratory System in Vertebrates.
Study the evolution of the lungs and respiratory tract in terrestrial vertebrates. Specify the progressive features of the organization. Designate in the Fig.2. Fill in the Chart 1.

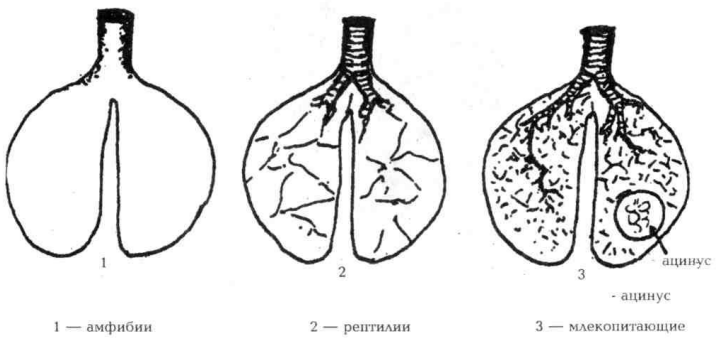


Fig 2. The Respiratory Systems of Vertebrates **Chart 1**

Class	Respiratory System Characteristics	
	Respiratory tract	**Respiratory organ**
Lancelet (Acrania)		
Fishes		
Amphibians		
Reptiles		
Mammals		

4.Congenital Malformations of the Human Respiratory System Provided by the Ontogeny and Phylogeny.

Study the CM of the human respiratory system. Pay attention to the malformations reflecting the original connection of the digestive and respiratory systems: Cleft hard palate, esophagotracheal fistulas - ducts connecting the esophagus and trachea, bronchogenic fistulas and cysts.

Identify the malformations related with lungs development halt at various stages of organogenesis: agenesia, aplasia, hypoplasia of a lung tissue, defects of branching of a bronchial tree, etc.

5. Phylogeny of the Circulatory System in Vertebrates.

5.1 Perform a comparative analysis of the circulatory system of different classes of Vertebrates. To identify the main directions of evolution, to pay attention to the progressive features of the organization that led to warm-bloodedness. Fill in the Chart 2.

Chart 2

Class	**Number of Chambers in the Heart**	**Peripheral Blood**		
		Prevails in gas composition	**Body Temperature**	**Red Blood Cells**
Fishes				
Amphibians (larvae)				
Amphibians (adults)				
Reptiles				
Birds				
Mammals				

5.2. Study the transformation of arterial (Gill) arcs in vertebrates in the great arteries. Fill in the Chart 3.

Chart 3

Evolution of the Gill Arteries in Vertebrates

Gill arteries	Fishes	Amphibians	Reptiles	Birds	Mammals
1 pair					
II pair					
III pair					
IV pair					
V pair					
VI pair					

6. Congenital Malformations of the Circulatory System.

Study the CM of the circulatory system 2-chamber, 3-chamber heart, defects of the atrial and interventricular septum, aplasia of the great arteries, arterial (botallo) duct), analyze the onto- and phylogenetic provision of these anomalies.

NECESSARY SKILLS:

1. To identify the structural homology of the digestive, respiratory and circulatory systems in representatives of different classes and differences that allow to track the direction of evolutionary transformations.
2. To explain the origin of human carotid arteries, aortic arches, pulmonary arteries from laid gill arteries.
3. To characterize abnormalities of the human digestive, respiratory and circulatory systems provided in phylogeny and possible mechanisms of their origin.
4. To solve situational problems.

Student _____ Teacher_____

LESSON 18

«____»____202_

THEME: Phylogeny of the Urinary and Reproductive Systems. Ontogenetic Transformations and Congenital Malformations of the Urinary and Reproductive Systems in Humans.

AIM: To study the principles of phylogenetic transformations of the urinary and reproductive systems in Vertebrates and their formation in human embryogenesis, as well as possible CM of these systems.

INDEPENDENT WORK:

1.Main functions of the excretory system
2.Evolution of the excretory system in Invertebrates
3.Phylogeny of the urinary system of Vertebrates.
4.The correlation of the excretory and reproductive systems in Anamnias and Amnyotes.
5.The stages of laying and the structure of a pronephros, mesonephros and metanephros in humans.
6.Developmental abnormalities of the excretory and reproductive systems in human embryogenesis.

BASIC DEFINITIONS:

Agonadism-

Anorhism-

Acystia-

Hermaphroditism-

Hypogonadism-

Microorchidism-

Hypospadias-

Cryptorchidism-

Ovotestis-

Sexual dimorphism-

Epispadias-

CLASSWORK:

1. Phylogeny of the Urinary system.

1.1. Using the Chart, analyze the phylogenetic changes in the excretory system in Invertebrates.

Chart 1

Invertebrates	**Type of the Excretory System**	**Basic Structures**
Protozoa	-	Contractile vacuoles
Flatworms	Protonephridia	Solenocytes-stellate cells with tubules
Round worms	Protonephridia	Giant excretory cell
Ringed worms (Annelida)	Metanephridia	Funnel (nephrostome) with a short duct
Arthropods	Metanephridia (Malpighi vessels)	Numerous blind-closed intestinal processes on the border of the middle and posterior intestine

1.2.Comparative characteristics of nephrons in a row of Vertebrates.

Study the structure of the nephrons of the head (pronephros), body (mesonephros) and pelvic (metanephros) kidneys. Designate (Fig. 1).

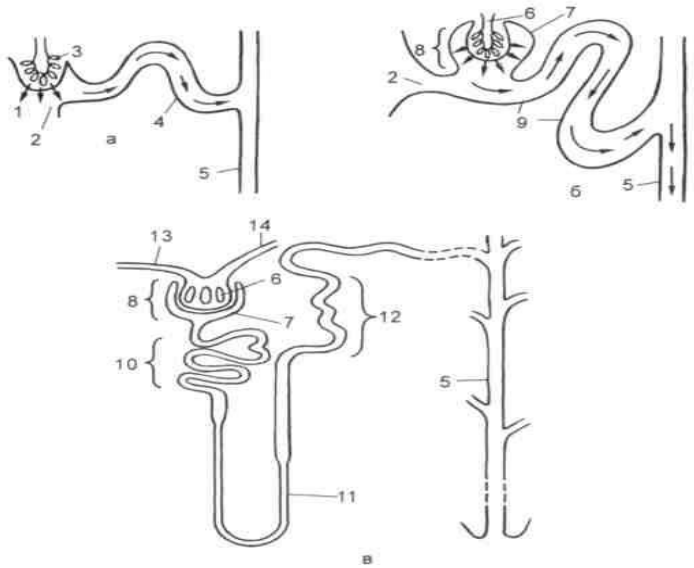


Fig.1 Evolution of the Nephron in Vertebrates

а - Nephron of the Pronephros; б-Nephron of the Mesonephros; в-Nephron of the Metanephros.

1.3. The Correlation of the Urinary and Reproductive Systems in Vertebrates.
Study evolutionary stages of excretory organs in the row of Vertebrates. Pay attention to the phylogenetic transformations of the renal tubules of the Pronephros of Vertebrates in the embryogenesis. Make the appropriate designations in the Fig. 2, fill in Chart 2.

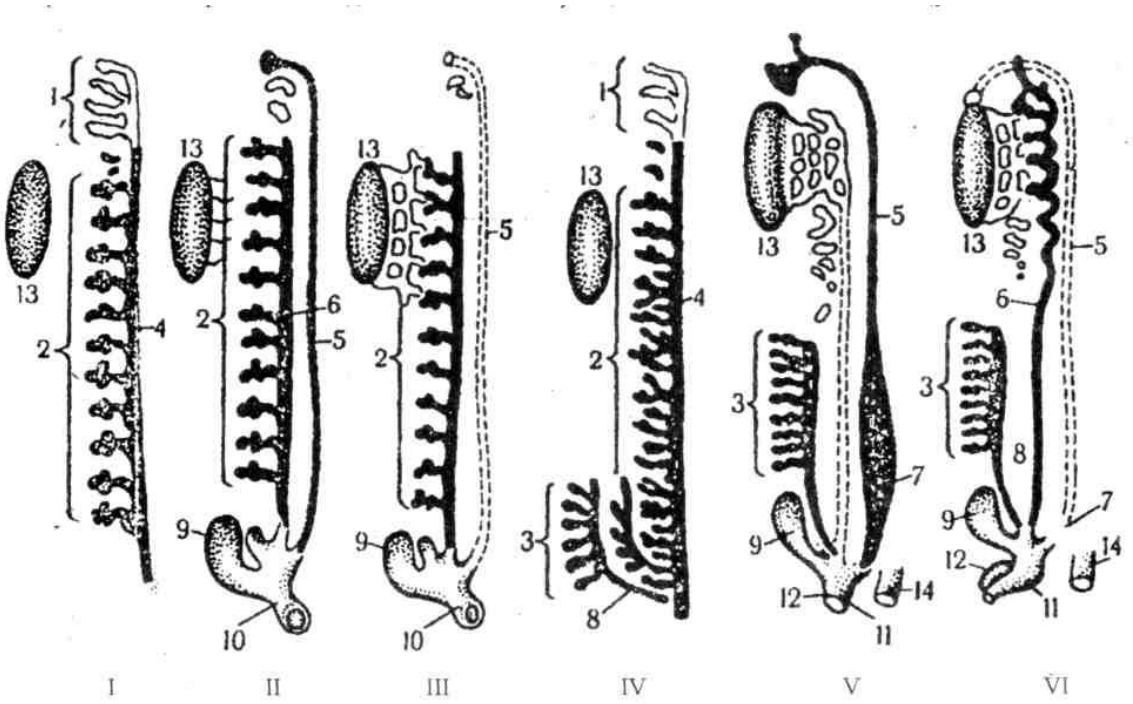


Figure 2. Development of the Urinary and Reproductive Systems in Vertebrates

1- _____ 6-_____ 11-_____
2-_____ 7-_____ 12-_____
3-_____ 8-_____ 13-_____
4-_____ 9-_____ 14-_____
5-_____ 10-_____

Chart 2

Transformations of renal tubes of the Mesonephros

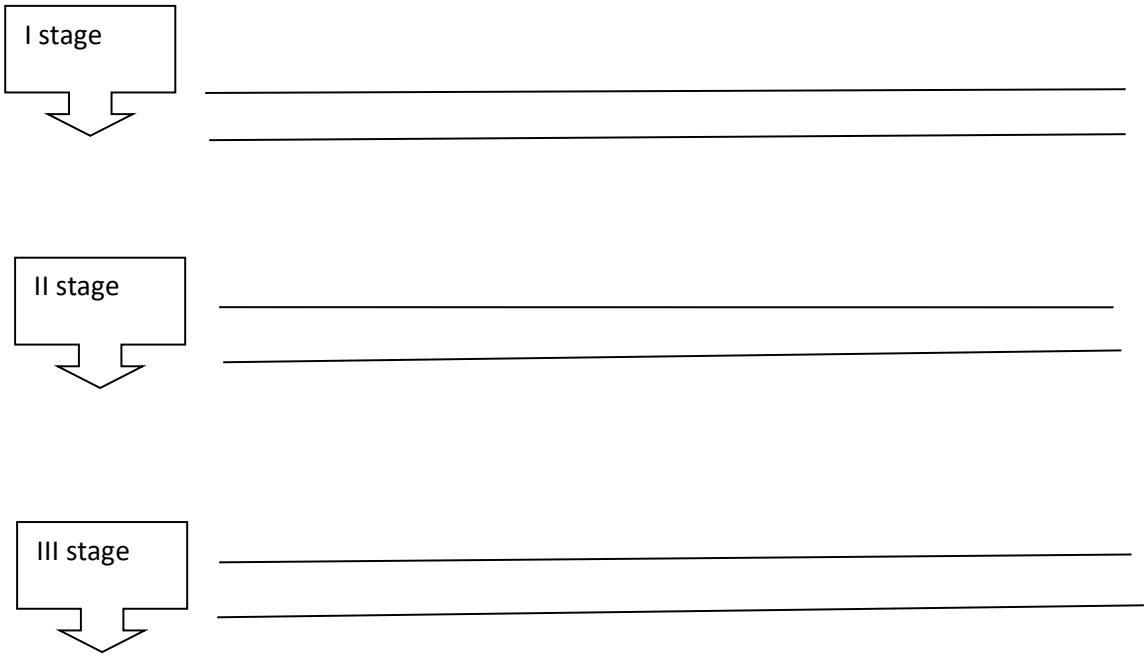
Vertebrates	**Ducts, functions**	
	Paramesonephric ducts (Mullerian duct)	**Mesonephric duct (Wolffian duct)**
Anamnia Female Male		
Amniota Female Male		

2.Congenital Malformations (CM) of the Urinary System in Humans.
Analyze the genetic and phylogenetic provision of the urinary system CM.
Study some CM of the urinary system (kidney agenesis; kidney hypoplasia; kidney dystopia; abnormalities of the form; abnormalities of the ureters, bladder, atypical position of the urethra).

3. Phylogeny of the Reproductive System in Invertebrates and Vertebrates. Pay attention to the transition from hermaphroditism to the dioecious reproductive system.

3.1. Study and record the stages of sex differentiation in human ontogenesis.

Sex differentiation is a complex and multi-step process from the moment of fertilization to puberty.



4. CM of the Human Reproductive System.

4.1 Study some abnormalities in the development of the human reproductive system, as well as possible onto- and phylogenetic causes of abnormalities.

4.2. Analyze intersexual forms in humans and fill in the Chart.

Type of Hermaphrodism	**Possible Karyotypes**	**Gonads**	**Genitals**
1.True			
2. False male hermaphroditism			
3.False female hermaphroditism			

NECESSARY SKILLS:

1.To identify elements of the urinary and reproductive systems and track their homology.

2.To study principles of onto- phylogeny of the genital and urinary system, explain the abnormalities of its structure.

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LESSON 19 (5)

THEME: Phylogeny of the Integration Systems in Vertebrates, Onto- and Phylogenetic Provision of the CM of the Nervous and Endocrine Systems.

AIM: to study the development of the nervous system in Vertebrates, the evolution of the brain, the laying and development of sensory organs and endocrine system; genetic and phylogenetic provision of CM of those systems in humans.

INDEPENDENT WORK:

1.Functions and main stages of evolution of the nervous system in Invertebrates and Vertebrates.

2. Structural features and functions of the brain of each class of Vertebrates.

3.Directions of evolution of the brain in Vertebrates (ichthyopsid, sauropsid, mammal type).

4.The significance and evolution of sensory organs in Vertebrates.

5.Stages of development of the Central and peripheral nervous system and sensory organs in human embryogenesis.

6.Laying and development of endocrine glands in human embryogenesis.

7.The main CM of the nervous and endocrine systems in humans.

BASIC DEFINITIONS:

Agyria-

Anencephaly-

Corticalization -

Microencephaly-

Pituitary

nannism (dwarfism) –

Thyroid dwarfism-

Spina bifida-

CLASSWORK:

1.Phylogeny of the Nervous System and Sensory Organs in Vertebrates.

1.1. Study the brain and spinal cord on the Fig 1, indicating the embryonic development of the brain and spinal cord in Vertebrates.

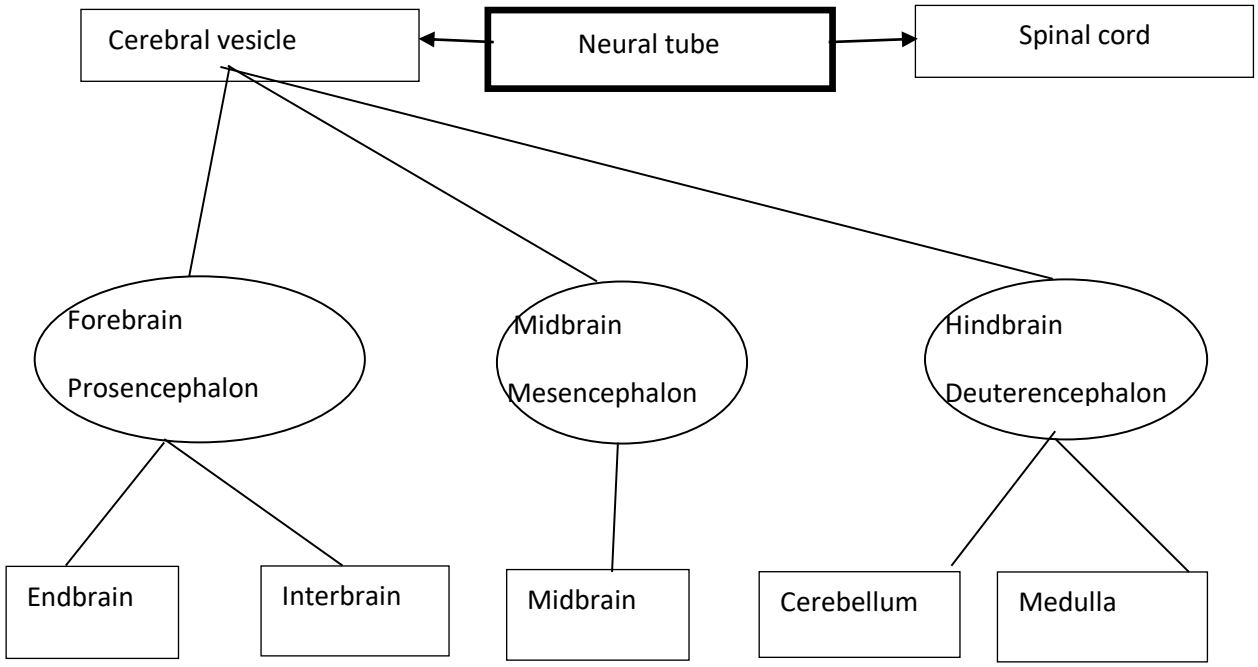


Fig 1. Diagram of Development of the Brain Regions in Vertebrates

1.2. **INDEPENDENT WORK** To analyze and draw the brain structure in animals of different classes of Vertebrates. To indicate the brain regions and identify their homology. Pay attention to the appearance and evolution of the cerebral cortex.

1 Fishes

2 Amphibians.

3. Reptiles

4. Birds

5.Mammals

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

1.3. Fill in the Chart 1 characteristic morphological features of the brain in a row of Vertebrates, specify the type of brain.

Chart 1

Brain Comparison Chart in Vertebrates

Class	Characteristics of the Brain	Brain Type
Fishes		
Amphibians		
Reptiles		
Birds		
Mammals		

2. Cephalization Processes in Hominid Phylogeny.

2.3 Study the location of the main craniometric points on the skulls of apes, hominid fossils and modern humans (Fig.1).

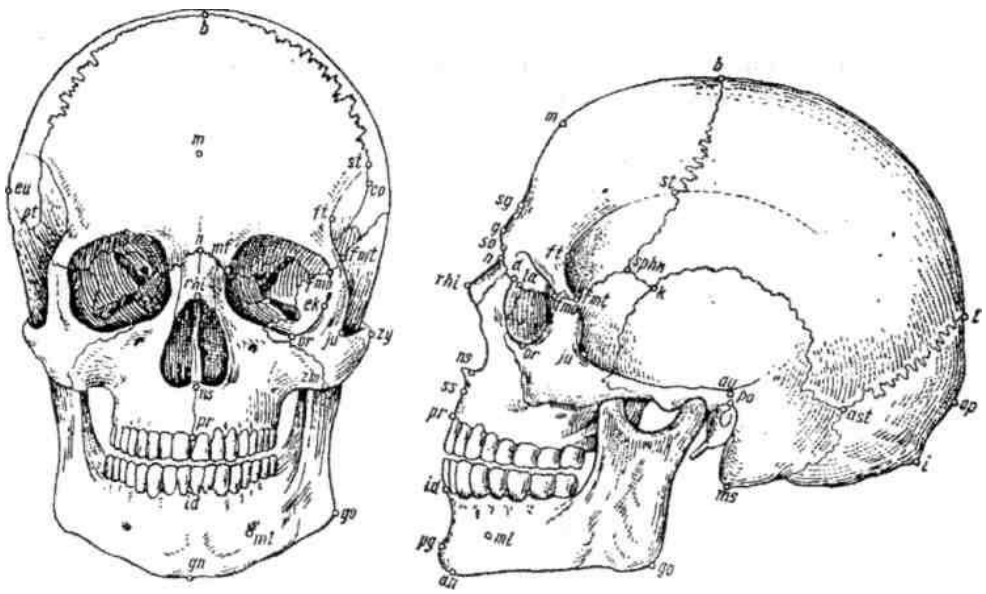


Fig. 1. Main Craniometric Points of the Human Skull.

Main Unpaired Craniometric Points of the Skull

Bregma (b) - the point of intersection of the coronal and sagittal sutures;

Glabella (gl) - the most prominent forward point of the frontal bone between upper edges of the orbits;

Metopion (m) - the point of intersection of the median plane with a horizontal line connecting the most prominent points of the frontal hillocks;

Nasion (n) - the middle of the nasolabial suture;

Nasospinale (ns) - the point of intersection of the median plane with the line connecting the lower edges of the pear-shaped hole;

Opistokranion (op) - - the occipital point distant from the glabella in the median plane;

Prostion (pr) - the most protruding point of the alveolar edge of the upper jaw in the median plane;

Basion (ba) - the lowest point of the front edge of the large occipital hole;

Gnation (gn) - the lowest point of the lower jaw in the median plane.

Main Paired Craniometric Points of the Skull:

Orbital (or) - the point of the lower edge of the eye orbit;

Porion (po) - a point in the middle of the upper edge of the external auditory orifice;

Gonion (go) - a point on the outer edge of the angle of the lower jaw;

Zygion (zy) - most lateral point of zygomatic arch;

Euryon (eu)- the point farthest from the median plane on the lateral surface of the skull.

2.2. Calculation of the main craniometric parameters of hominids.

Cranial Index (C.I.)= Transverse diameter/Longitudinal diameter x100

The longitudinal diameter is the distance from the glabella to the opisthocranion

The transverse diameter is the distance between the paired eurion points.

Criteria

C.I. ≤ 74,9 - Shape of the skull is *Dolichocranial*

75,0 ≤ **C.I.** ≤79,9- Shape of the skull is *Mezocranial*

C.I. ≥80- Shape of the skull is *Brachycranial*

Fill in the Chart.

Chart 2

Basic Size and Shape of Hominid Skulls

№	Hominids	Longitudinal diameter (cm)	Transverse diameter (cm)	Cranial index (C.I.)	Shape of the skull	The volume of the brain (cm^3)
1	Pithecanthropus					
2	Sinanthropus					
3	Neanderthal					
4	Cromagnon					
5	Homo sapiens					

On the basis of craniometric analysis of skulls, considering the brain volume of hominids and modern humans, specify the features of their similarity and difference. Indicate the role of cephalization in the evolution of the human brain and nervous activity.

3. Congenital malformations of the nervous system.
Analyze the genetic and phylogenetic provision of the nervous system CM. On the charts, slides, photos study developmental anomalies of the human nervous system and sensory organs.

4. Phylogeny of the Human Endocrine System.
Analyze the evolution of endocrine glands, laying in the embryogenesis. Fill the Chart 3.

Chart 3

Embryogenesis of the Endocrine Glands and Their Significance in the Human Body

No	Endocrine glands	Hormones produced	Pathology	
			Hypofunction	Hyperfunction
1	Pituitary			
2	Thyroid			
3	Parathyroid			
4	Thymus			
5	Adrenals			
6	Pancreas			
7	Female gonads			
8	Male gonads			

4.1.**CM of the Endocrine System.**
Analyze the genetic and phylogenetic provision of congenital malformations of endocrine glands (aplasia / hypoplasia/hyperplasia)

NECESSARY SKILLS:
1.To use the principles of brain onto- and phylogenesis for explanation of the human nervous system abnormalities (anencephaly, agyria, microcephaly, rachischis, etc.).
2.Using measuring instruments, perform craniometric analysis.

Student _____ Teacher_____

«____»_____20___

LESSON 20

THEME: Postembryonic Ontogeny, its Periodization in Humans. Anthropometry. Final Lesson in the Part III.

AIM: To study the postembryonic period of human ontogenesis and patterns of age-related morphological variability; to analyze the anthropometric signs of sexual dimorphism; to master the methods of anthropometry and anthroposcopy.

INDEPENDENT WORK:

1.Characteristics of the main stages of postembryonic ontogeny.
2.Body growth, types of growth
3.Age and gender morphological characters in humans.
4.Aging as a regular stage of ontogeny. Theory of aging.
5.The role of social and biological factors in human longevity.

BASIC DEFINITIONS:

Anthroposcopy —

Anthropometry —

Gerontology —

Geriatrics-

Sexual dimorphism -

Craniometry —

Osteometry —

Puberty —

Somatometry —

Juvenile period —

CLASSWORK:

1. Periods of the Human Postembryonic Ontogeny.

Analyze the periods of postembryonic ontogeny: juvenile (pre-productive), maturity (reproductive), old age (post-productive).

Study in the Charts and write down the human age physiological signs:

1.Manifestation of secondary sexual characteristics in humans. Evaluation of the somatic and sexual development of the human. Fill in the Chart 1.

Chart 1.

Morphological and physiological signs of puberty in males

Secondary sexual characteristics	**Age of appearance (years)**
The beginning of growth of testicles and penis The beginning of the prostate activity Growth of the larynx (cartilage of the larynx) Further growth of testicles and penis Sealing of the areola The beginning of voice change (mutation) Hair growth in the armpits and pubic areas The beginning of hair growth on the face and body in the male type Appearance of sperm in the semen Final voice mutation Cessation of skeletal growth	

Morphological and physiological signs of puberty in females

Secondary sexual characteristics	**Age of appearance (years)**
Growing pelvic bones and rounding the buttocks Nipple Growth The beginning of growth of the mammary glands The appearance of pubic hair The growth of the external and internal genital organs Pigmentation of the nipples, breast enlargement The appearance of hair in the armpits First menstruation Establishment of the menstrual cycle Cessation of skeletal growth	

2.Methods for studying human morphological signs (anthroposcopy, anthropometry).

2.1. Study the main anthropometric points to perform an anthropometric research.

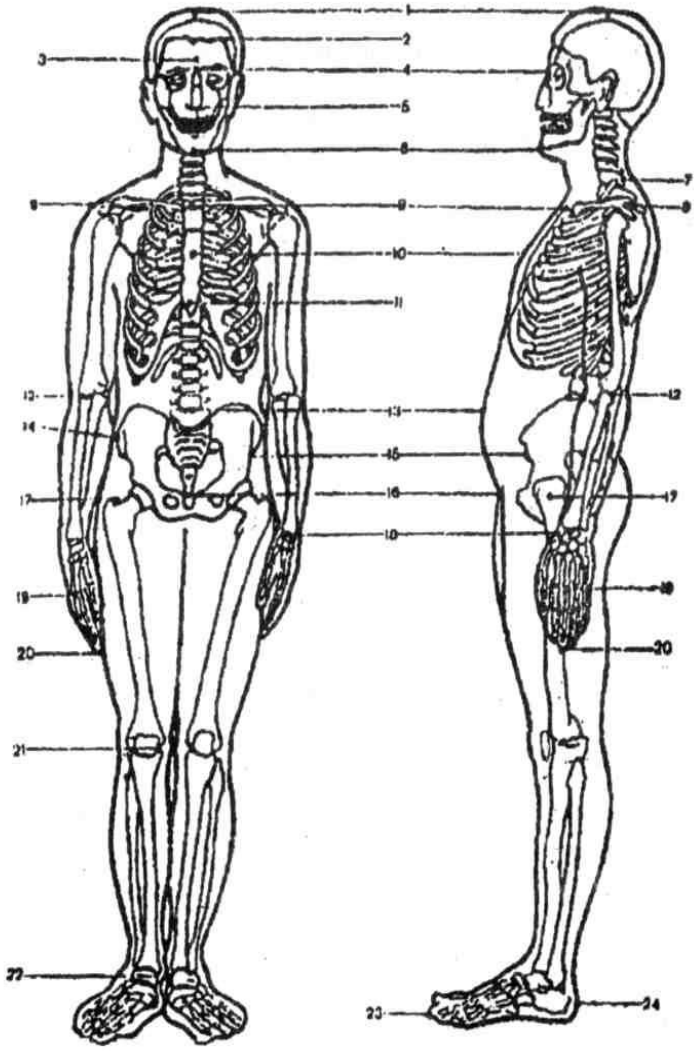


Fig. 1. Anthropometric Points

1.Apical (vertex)	14. Ileal -crest (ilispinale)
2.Hair (trichion)	15. Ileal anterior(iliospinale anterion)
3.Frontal (metopion)	16. Pubic (symphysion)
4. Upper nasal (nasion)	17. Acetabular (trochanterion)
5.Lower nasal (sabnasale)	18. Subulate (stylion)
6.Chin (gnathion)	19. Phalange (phalangion)
7.Cervical (cervicale)	20. Finger (dactilion)
8. Upper sternum (subrasternale)	21. Upper tibia (tibiable)
9. Shoulder (acromion)	22. Lower tibial (spherion)
10. Middle sternum (mesosternale)	23. Terminal
11. Lower sternum (xyphation)	24. Heel (pternion)
12. Radius (radiale)	
13. Navel (jmphalion)	

Anthropometry technique

1.To measure the standing height, stand straight with the arms down, placing the heels together, toes apart, touching the height meter stand with three points of the body: heels, buttocks and interscapular area (but not the back of the head). The head is positioned so that the line connecting the lower edge of the orbit and the upper edge of the tragus is horizontal (with an accuracy of up to 0.5 cm).

2.Body weight is measured by medical scales with an accuracy of 0.1 kg.

3.The chest circumference is measured with an accuracy of 0.5 cm. The tape is applied to the back along the line of the angles of the shoulder blades, and in front - along the lower segment of the areolae. In girls, the tape is applied along the upper edge of the fourth rib (above the breast glands).

4.The shoulders width is measured between two humeral points (9) - the points of the humeral processes of both shoulder blades that are the most protruding outwards.

5.The pelvis width is measured between the two ileal-scalloped points (14) - the most protruding points to the outside of the crests of the iliac bones.

6.The head is measured with the largest dimensions of the cranium.

7.The arm length is measured from the humeral point to the fingertip — the most protruding distal of the pulp of the third finger (from 9 to 20).

8.The leg length is determined by measuring the distance from the acetabular (17) bone to the heel (24)

9. The arm span is measured from the back side with a measuring tape between the right and left finger points (20) of the arm extended parallel to the floor.

2.2. Write your own anthropometric parameters.

1. Sex_____
2. Age_____
3. Body weight_____
4. Body length_____
5. Arm Span_____
6. Arm length_____
7. Shoulder width_____
8. Neck circumference_____
9. Pelvis width_____
10. Chest circumference_____
11. Waist circumference_____
12. Leg length_____
13. Longitudinal cranial size _____
14. Transverse cranial size _____
15. Head circumference_____

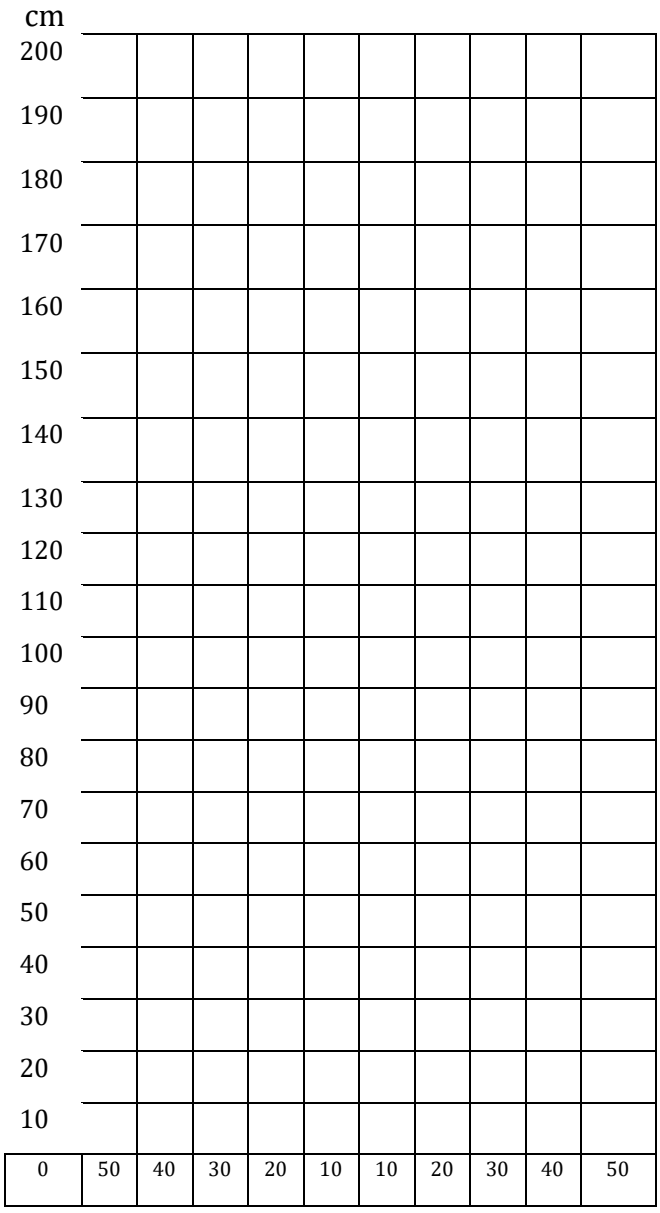
The results of somatometry: determine the body constitution, using the Pigner's index: **I=L-(P+T)** where L is the length of the body, P-body weight, T-chest circumference.

The evaluation criteria of body type

Body type	Pigner's index
Hypersthenic	<10
Normosthenic	от 10 до 30
Hyposthenic	>30

Make a conclusion about your body type.

2.3. Draw a diagram of your own anthropometric parameters



3. Anthroposcopy-the Description of the Human body as a Whole and its Parts:

development of the fat layer - _____ chest shape - _____
muscular development - _____ belly shape - _____
skin pigmentation - _____ back shape- _____
head shape - _____ leg shape - _____
hair color - _____
eye color - _____
secondary sexual characteristics - _____
nose shape - _____

NECESSARY SKILLS:
1.Using measuring instruments, perform anthropometric research of a person
2. Perform an anthroposcopic examination of a person

Student _____ Teacher_____

PART IV "PARASITOLOGY"

«____»_____201__

LESSON No 21

THEME*:* Parasitism as a Form of Antagonistic Biotic Bonds in Nature. Parasitic Protozoans - Pathogens of Leishmaniasis, Trypanosomiasis, Trichomoniasis, Giardiasis, Amoebiasis, Balantidiasis, Toxoplasmosis, Malaria.

AIM: To study the biological basis of parasitism and human parasitic diseases, morphological features and peculiarities of parasitic Protozoa development cycles. To study methods of diagnostics and preventive measures of leishmaniasis, trichomonosis, trypanosomosis, lambliosis, amoebiasis, balantidiasis, toxoplasmosis, malaria.

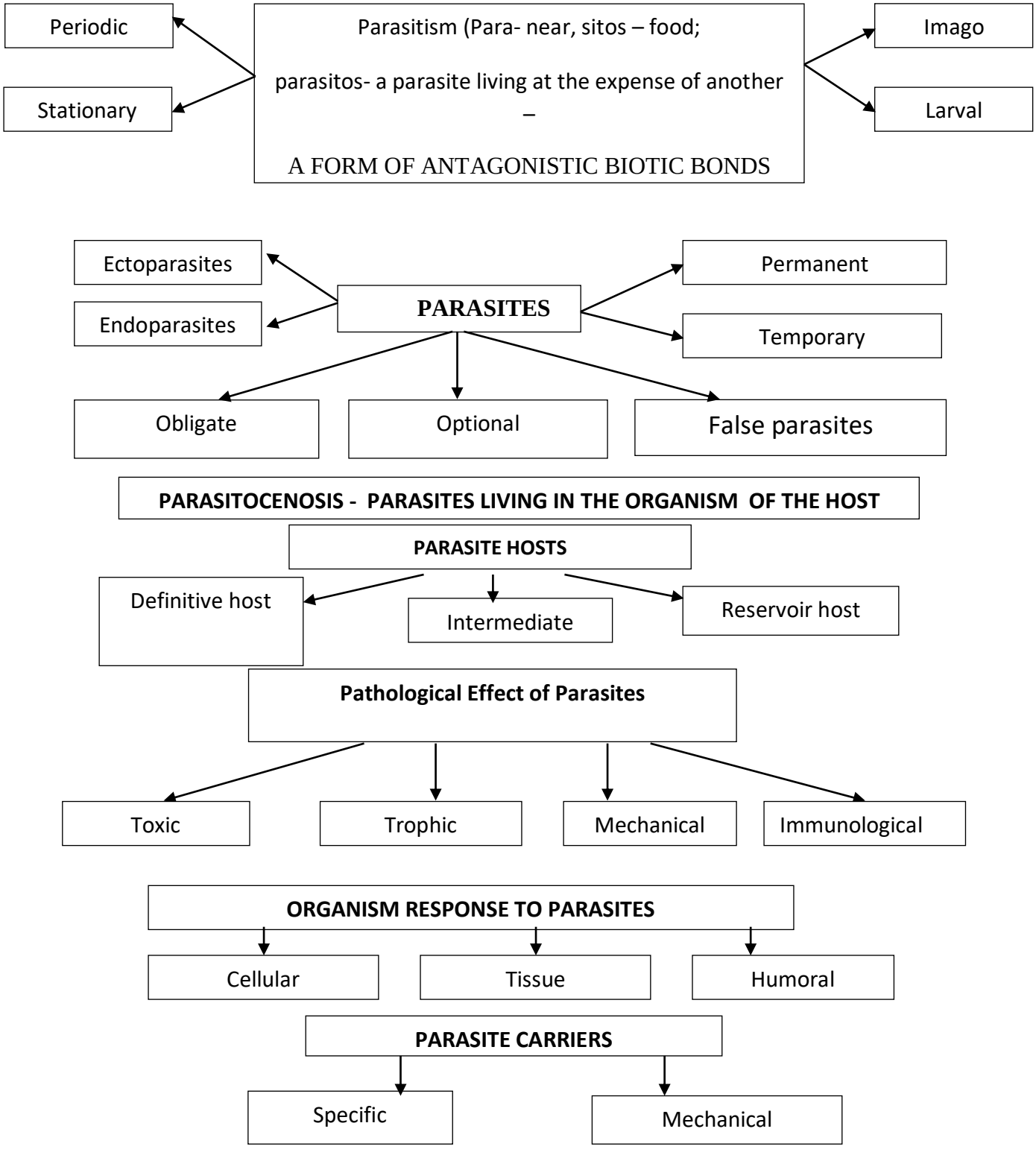
INDEPENDENT WORK:

1. Definition of ecology as biological science.
2. Basic concepts (biotope, biocenosis, biogeocenosis, agrocenosis).
3. Forms of biotic bonds in nature.
4. Forms of antagonistic biotic bonds.
5. Classification of parasitic forms of animals, their pathogenic effect on humans.
6. Latin and Russian names of representatives of the type Protozoa, class Flagellata.
7. Development cycle of Leishmania , trypanosome, lamblia.
8. Morphological features of lamblias, trichomonas, tripanosome, leishmania.
9. Infection pathway of lambliosis, leishmaniasis, trypanosomiasis, trichomonosis and invasive stage for humans.
10. Diagnostic methods and preventive measures of these diseases.
11. Contribution of local scientists to the development of medical parasitology.
12. The main features of the representatives of the classes Sporozoa, Sarkodina, Infuzoria.
13. Morphological features of a pathogen erythrocyte development stages in three- day, four-day malaria and tropical form of malaria.
14. Morphological features of intestinal balantidia.
15. Development cycles and invasive stages for amoebiosis, malaria, balantidiasis, toxoplasmosis infected humans.
16. Infection pathway of amoebiasis, malaria, balantidiasis, toxoplasmosis.
17. Diagnostics and preventive measures of toxoplasmosis, amoebiosis, balantidiasis, malaria.

CLASSWORK:

1. To study the Chart "Parasitism as a form of antagonistic biotic bonds in nature"

Chart 1.



Pathogen Transmission Ways:

1. Common – _____
_____
2. Droplet – _____
_____
3. Contact – _____
_____
4. Oral – _____
_____
5. Parenteral – _____
_____
6. Hemotransfusion – _____
7. Percutaneous – _____
8. Transmissive – _____
9. Transplacental – _____
10. Transovarial – _____
_____
11. Sexual – _____
12. Contamination – _____

2. Type PROTOZOA – Phylum Protozoa.

2.1. Class FLAGELLATA – Classis Flagellata.

Leishmania a) **Leishmania tropica (Leptomonas form) – a pathogen of** _____
b) **Leishmania donovani (intracellular form) – a pathogen of** _____

2.1.1. Under the microscope view and sketch the morphological features of the pathogen of cutaneous leishmaniasis. Indicate on the figure: cytoplasm, nucleus, blepharoplast, flagellum. Fill in the Chart 2 Leishmania life cycle.

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

Fig. 1. L. tropica. Mag. 7x40.

2.1.2. Demonstration of **L. donovani –** a pathogen of visceral leishmaniasis.

2.2. **Trypanosomes** –

a) **Trypanosoma gambiense – a pathogen of**_____
b) **Trypanosoma rhodesiense – a pathogen of**_____

Under the microscope at mag.7x40 view and sketch morphological features of the pathogen of African trypanosomiasis. Indicate on the Fig: cytoplasm, nucleus, blepharoplast, flagella, undulating membrane. Fill in the Chart 2 Trypanosoma life cycle.

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

Fig. 2. T. gambiense. Mag. 7x40.

2.3.**Lamblia or Giardia (Lamblia intestinalis) –** a pathogen of _____

Under the microscope at mag.7x40 view and sketch the morphological features of Lamblia. Indicate on the Fig: nucleus, aksostyle, flagell. Fill in the Chart 2 Lamblia life cycle

.

1._____

2._____

3._____

Fig. 3. Vegetative form of L. intestinalis Mag. 7x40.

Chart 2.

PARASITIC PROTOZOA – FLAGELLATA

Parasitic disease, Latin name of the pathogen	**Morphological features: Size, form**	**Infection Pathways And invasive stage for humans, localization**	**Definitive host:**	**Vectors:**	**Natural reservoir**	**Diagnostic Methods, material**
1. Cutaneous leishmaniasis _____ _____						
1. 2. Visceral leishmaniasis _____ _____						
3. African trypanosomiasis _____ _____						
4. American trypanosomiasis _____ _____						
5. Lambliosis _____ _____						
6. Urogenital trichomoniasis _____ _____						
7. Intestinal trichomoniasis _____ _____						

2.4. **Trichomonas***:*

a) **Trichomonas vaginalis – a pathogen of**_____

b) **Trichomonas hominis – a pathogen of** _____

Under the microscope at mag. 7x40 view and sketch the morphological features of Trichomonas - pathogens of urogenital trichomoniasis. Indicate on the Fig: nucleus, axostyle, flagellum. Fill in the Chart. 2 Trichomonas life cycles and trichomoniasis infection pathways.

1._____

2._____

3._____

3.Class Sarcodina – Classis Sarcodina.

Dysentery amoeba (Entamoeba histolytica) – a pathogen of_____.

Study and sketch the Diagram of the life cycle of a Dysentery Amoeba. Indicate on the Fig: cyst, vegetative small (intestinal lumen) form - (minuta), vegetative large (tissue) form - (magna).

1._____

2._____

3._____

Fig. 1. E. histolytica. Life Cycle (diagram)

4. Class Sporozoa – Cl. Sporozoa.

4.1. T**oxoplasma (Toxoplasma gondii) – a pathogen of**_____.

Study and sketch the Diagram of the life cycle of a Toxoplasma. Indicate on the Fig: ovocyst, pseudocyst , cysts, endozoid, macrogametes, microgametes.

1._____

2._____

3._____

4._____

5._____

6._____

Fig. 2. T. gondii. Mag. 7x90. Life Cycle (diagram*)*

4.2. Malaria Plasmodium (Plasmodium vivax) – a pathogen of _____

Under the microscope at mag. 7x90 (immersion lens) view permanent preparations of blood smears of a patient with malaria, pay attention to the stages of the ring and erythrocyte schizont. Draw a diagram of the development cycle of malarial plasmodium. Indicate on the Fig: sporozoites, schizonts in liver cells, schizonts in red blood cells, myrozoites, gametocytes, gametes, zygote, ookinet, oocyst.

1._____
2._____
3._____
4._____
5._____
6._____
7._____
8._____
9._____

Fig.. 3. Malaria Plasmodium Development Cycle

INDEPENDENT WORK. Fill in the Charts 2 and 3.

Chart 3.

Parasitic Protozoa – Sarcodina, Sporozoa, Infuzoria.

Parasitic disease, Latin name of the pathogen	**Morphological features: Size, form**	**Infection Pathways And Invasive**	**Hosts of a Parasite**		**Diagnostic Methods, Material**
			Definitive	**Intermediate**	
1.Dysentery Amoeba (amoebiosis) _____ _____					
2.Balantidiasis _____ _____					
3. Toxoplasmosis _____ _____					
4. Tropical Malaria _____ _____					
5. Three-day malaria_____ _____					
6. Four-day Malaria _____ _____					

Abstract on the Theme

BASIC DEFINITIONS:

Vegetative form-

Gametocyte-

Invasive stage -

Encystation –

Commensalism-

Larval stage -

Merozoit-

Mutualism-

Obligate parasites-

Parasitism –

Pathogenicity –

Intestinal lumen form-

Sinoquia -

Symbiosis –

Sporozoit-

Ovocyst -

Optional parasite-

Cyst carrier -

Definitive host –

Intermediate host-

Schizogony –

Schizont -

Excystation –

Ectoparasite- –

Endoparasite –

NECESSARY SKILLS:

1. To identify the erythrocyte development stages of Malaria plasmodium in microscopic examination of a human blood smear.
2. To identify the dysenteric amoeba and balantidia according to morphological features.
3. To identify erythrocyte schizonts P.vivax; P. malaria; P.ovale; P. falciparum.
4. Make microscopic preparations.
5. Identify the representatives of the Class Flagellata.

6. To identify leishmania, trypanosomes, giardia, trichomonads under a microscope according to morphological features.

Student_____ Teacher_____

«____»_____201__.

LESSON No 22

THEME: (Cl. Flukes) - Pathogens of Fascioliasis, Dicroceliosis, Opisthorchiasis, Paragonimiasis, Schistosomiasis.

AIM: To study the characteristic morphological features of flatworms of the Class Flukes; to analyze the development cycles of hepatic, cat (Siberian), lanceolate, pulmonary, blood flukes - pathogens of fascioliasis, opisthorchiasis, dicrocoeliasis, paragonimiasis, schistosomiasis – human parasitic diseases; preventive measures of trematodoses**.**

INDEPENDENT WORK:

1. Latin names of representatives of Flatworms.
2. Morphological features and development cycles of hepatic, feline, lanceolate, pulmonary, blood suckers.
3. Infection pathways and invasion stages for the main and intermediate hosts.
4. Diagnostics and preventive measures of fasciolosis, dicrocelosis, opistorhosis, paragonimosis, schistosomiasis.

CLASSWORK:

TYPE Flatworms – Ph. Plathelminthes.
Class Flukes – Cl. Trematodes.

1. Liver fluke (Fasciola hepatica) – a pathogen of _____.

Under a magnifier view the preparation of the liver fluke, study its morphological features. Sketch the life cycle of the liver fluke, its morphology. Fill in the Chart 1 basic morphological features. Indicate on the Fig: buccal sucker, ventral sucker, blind ends of intestines, uterus, ovaries, testes, egg, miracidium, sporocyst, redium, cercaria, adolescaria, as well as the intermediate host and its place in the life cycle of the parasite.

1._____
2._____
3._____
4._____
5._____
6._____
7._____
8._____
9._____
10._____
11._____

Fig. 1. _____

2. Cat fluke (Opisthorchis felineus) – a pathogen of _____.

At mag. 7x8 view the preparation of a cat (Siberian) fluke, study morphological features, sketch the life cycle diagram. Indicate: buccal and ventral suckers, ovaries, testes, uterus, egg, miracidium, sporocyst, radium, cercaria, metacercaria; intermediate hosts and their place in the life cycle of the parasite.

1._____
2._____
3._____
4._____
5._____
6._____
7._____
8._____
9._____
10._____
11._____

Fig. 2. _____

3. Lanceolate fluke (Dicrocoelium lanceatum) – a pathogen of_____.

At mag. 7x8 view the preparation of a lanceolate fluke, study morphological features, sketch the life cycle diagram. Indicate buccal and ventral suckers, ovaries, testes, uterus, egg, miracidia, sporocyst, redia, cercaria, metacercaria; intermediate hosts and their place in the life cycle of the parasite

1._____
2._____
3._____
4._____
5._____
6._____
7._____
8._____
9._____
10._____
11._____

Fig. 3. _____

INDEPENDENT WORK. Fill in the chart 1

Chart 1

Parasitic Flatworms- Flukes

Disease, Parasite Russian and Latin Name	Morphological Features: size, form etc.	Infection Pathway, Invasive Stage	Hosts, Localization		Diagnostic Methods, Material	Preventive Measures
			Definitive	Intermediate		
1. Fascioliasis _____ _____ _____ _____						
2. Opisthorchiasis _____ _____ _____ _____						
3. Dicroceliosis _____ _____ _____ _____						
4. Paragonimiasis _____ _____ _____ _____						
5. Clonorchiasis _____ _____ _____						
6. . Intestinal schistosomiasis__ _____ _____ _____ _____						
7. Urogenital schistosomiasis__ _____ _____ _____						
8. Japanese schistosomiasis _____ _____ _____						

Abstract of the Theme

BASIC DEFINITIONS :

Adolescaria –

Autoinvasion –

Biohelminths –

Dicroceliosis –

Geohelminths –

Metacercaria –

Opisthorchiasis –

Paragonimiasis –

Redia –

Sporocyst –

Tegument –

Trematodosis –

Fascioliasis –

Cercaria –

Schistosomiasis –

NECESSARY SKILLS:

1. To determine the species of the Flukes representatives.
2. To distinguish a cat fluke from a lanceolate fluke by their morphological characteristics.
3. To justify the methods of laboratory diagnosis of these representatives.
4. To identify measures of personal and social prevention of trematodosis.

Student_____ Teacher_____

«____»_____201__.

LESSON No 23

THEME*:* Parasitic Tapeworms - Pathogens of Teniosis, Teniarinhosis, Hymenolepidosis, Echinococcosis, Diphyllobothriasis.

AIM: To study the morphological features and characteristics of the parasitic worms development cycles. To define the adaptation to a parasitic lifestyle. To study the diagnostics and prevention of teniosis, teniarinhosis, hymenolepidosis, echinococcosis, diphyllobothriasis**.**

INDEPENDENT WORK:

1. Russian and Latin names for representatives of the class Tapeworms.
2. Class Tapeworms characteristics and adaptation to parasitism.
3. Morphological structural features of the representatives of the class Tapeworms.
4. Infection pathways and invasive stages for the definite and intermediate hosts.
5. Diagnostic methods and preventive measures for teniosis, teniarinhosis, hymenolepidosis, echinococcosis, diphyllobothriasis.

CLASSWORK:

1. **Type Flatworms – Ph. Plathelminthes.**
   Class Tapeworms – Classis Cestodes.

1.1. **Pork (armed) tapeworm *(*Taenia solium) – a pathogen of _____.**

Under a magnifier and microscope at mag. 7x8 view permanent microscopic preparations of the scolex, hermaphroditic and mature segments of the pork tapeworm. In the figure, designate: suckers on the scolex, a crown of hooks; uterus, ovary (3 lobes), testes in the hermaphroditic segment, uterine branches in the mature segment. Study and write down the parasite's life cycle diagram.

Fig. 1. _____

1.2. Bull (unarmed) tapeworm (Taeniarhynchus saginatus) – a pathogen of _____
Under the magnifier and microscope at mag. 7x8 view permanent microscopic preparations of the scolex, hermaphroditic and mature segments of the bull tapeworm; sketch and designate: suckers, hook whisk; uterus, ovary (2 lobes), testes, branches of the uterus. Sketch the parasite life cycle diagram.

Fig. 2. _____

1.3. Echinococcus (Echinococcus granulosus) – a pathogen of _____.
View a preparation of Echinococcus finna- echinococcal "air bubble"at mag. 7x8. Sketch the morphology of Echinococcus. Sketch the parasite life cycle diagram.

Fig. 3. _____

1.4. Dwarf tapeworm (Hymenolepis nana) - a pathogen of _____
At mag. 7x8 view the microscopic preparation of a dwarf tapeworm. Record the main morphological features. Sketch the parasite life cycle diagram.

Fig. 4. _____

1.5. Broad tapeworm (Diphyllobotrium latum) – a pathogen of _____
Under a magnifier and microscope at mag. 7x8 view and sketch microscopic preparations of the scolex and segments of the broad tapeworm. Indicate on the Fig.: slit-like suckers - bothria, uterus, ovary, testes, branches of the uterus. Sketch the parasite's life cycle diagram.

Fig. 5. _____

INDEPENDENT WORK. Fill in the Chart 1 Morphological features of Cestodes.

Chart 1

Morphological Features of Cestodes (Cl. Cestoda)

Disease, Parasite Latin Name	Helminth Morphological Features a				Finna (sketch)
	Size	Scolex	Proglottids		
			hermaphroditic	mature	
1. _____ Bull tapeworm (unarmed) _____ _____					
2. _____ Pork tapeworm (armed) _____ _____					
3. _____ Echinococcus _____ _____					
4. _____ Dwarf tapeworm _____ _____					
5. _____ Broad tapeworm _____ _____					

Symbols of Figures in the Chart 1:
1._____2._____3._____
4._____5._____ 6._____
7._____

Abstract of the Theme.

BASIC DEFINITIONS:

Alveococcosis –

Auto-reinvasion –

Hymenolepidosis –

Diphillobotriosis-

Coracidia –

Oncosphere –

Proglottid-

Plerocercoid –

Scolex –

Scolex -

Taeniarhinchosis –

Taeniosis –

Finna –

Cestodes –

Cysticercosis –

Cysticercoid -

Immature segment –

Hermaphroditic segment –

Mature segment –

Echinococcosis –

Echinococcus bubble –

NECESSARY SKILLS:
1. To determine the species of Cestode representatives.

2., To identify and differentiate hermaphroditic and mature segments of the bull, pork and broad tapeworms under a microscope;
3. To select and explain preventive measures for echinococcosis, hymenolepidosis, teniosis, teniarinhosis, diphyllobothriasis.

Student_____ Teacher_____

«____»_____201__.

LESSON No 24

THEME: Parasitic Roundworms - Pathogens of Ascariasis, Enterobiosis, Trichocephalosis, Trichinosis.
AIM*:* To study the characteristic features of the structure of Roundworms, basic morphological features and development cycles of an Ascaris, pinworm, whipworm, and muscle trichina. To study diagnostic methods and prevention measures of ascariasis, enterobiasis, trichocephalosis, trichinosis.

INDEPENDENT WORK:

1. Russian and Latin names of representatives of the type Roundworms, class Nematoda.
2. Features of the structure of representatives of the type Roundworms.
3. The main aromorphoses of Roundworms.
4. Development cycles of an Ascaris, pinworm, whipworm, muscle trichina.
5. The concept of bio-and geohelminthes.
6. Infection pathways and invasive stages for humans.
7. Diagnostic methods and preventive measures of ascariasis, enterobiosis, trichocephalosis, trichinosis.

CLASSWORK:

1. **Type Roundworms – Ph. Nemathelminthes**
   Class Nematodes – Cl. Nematoda.

1.1 **Ascaris (Ascaris lumbricoides) – a pathogen of _____.**
View the preparation of a human Ascaris. Pay attention to the features of sexual dimorphism. Fill in the chart 1 the basic morphological features. Study and sketch the Ascaris life cycle diagram.

Fig. 1. _____

1.2. Whipworm (Trichocephalus trichiurus) – a pathogen of_____
View the preparation of a female and male whipworm under the magnifier. Sketch the appearance of the male and female.

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

Fig. 2. _____

1.3. Pinworm (Enterobius vermicularis) – a pathogen of_____
At mag. 7x8 total view the preparation of a pinworm. Record the main morphological features. Draw and designate: vesicles, esophagus, esophagus bulb, intestines, anus, reproductive system.

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

Fig. 3. _____

1.4. Trichinella (Trichinella spiralis) – a pathogen of_____
At mag. 7x8 study a permanent preparation of trichinosis animal meat. Sketch the encapsulated Trichinella larva. Designate: muscle fibers, capsule, Trichinella larva.

1._____
2._____
3._____

Fig. 4. _____

INDEPENDENT WORK:

Fill in the chart 1 **Parasitic Roundworms.**

Chart 1

Parasitic Roundworms-- Nematoda

Disease, Parasite Latin Name	**Morphological Features of a Helminth (size, body shape)**	**Localization in the Human organism**	**Invasion Provisions**	**Diagnostic Methods**
1. _____ Ascaris _____ _____				
2. _____ Whipworm _____ _____				
3. _____ Pinworm _____ _____				
4. _____ Trichinella _____ _____				

2. Abstract of the Theme.

BASIC DEFINITIONS:

Ascariasis-

Autoinvasion-

Biohelminth –

Geohelminth –

Hypoderm -

Invasive stage –

Encapsulation -

Migration –

Sexual dimorphism –

Trichocephalosis –

Trichinosis –

Enterobiosis –

NECESSARY SKILLS:
1.To identify the whipworm, pinworm, ascaris, Trichinella larva according to morphological characteristics.
2. To identify the eggs of roundworm and whipworm under the microscope.
3. Choose adequate measures for personal and social prevention of trichinosis, trichocephalosis, ascariasis, enterobiasis.

Student_____ Teacher _____

«____»_____201__.

LESSON № 25

THEME: Parasitic Roundworms - Pathogens of Ancylostomiasis, Strongyloidiasis, Dracunculiasis, Filariasis. Methods of Laboratory Diagnostics of Helminthiasis.

AIM: To study the morphological features and developmental cycles of the hookworm (ancylostoma of the duodenum), intestinal threadworm, rishta, and vuchereria. To study diagnostic methods and measures of personal and social prevention of helminthiases in humans.

INDEPENDENT WORK:
1. Latin and Russian names for representatives of the type Roundworms, class Nematoda.
2. Morphological features of the structure of hookworm, intestinal threadworm, rishta, wuhereria, loa-loa, and brugia.
3. Methods of infection and preventive measures for ancylostomiasis, vuchereriosis, loiasis, brugiosis, strongyloidosis, dracunculiasis.
4. The main laboratory diagnostic methods of helminthiases in humans.

CLASSWORK:
Type Roundworms – Ph. Nemathelminthes.
Class Nematodes - Cl. Nematoda.
1. **Hookworm *(*Ancylostoma duodenale) – a pathogen of _____**
At mag. 7x8 study the preparation of a female and male Hookworm. Draw and indicate the features of sexual dimorphism and the pattern of migration of larvae in the human body.

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

Fig. 1. _____

INDEPENDENT WORK . Fill in the Chart 1 and 2

Chart 1

Parasitic Roundworms – Nematoda

Disease, Parasite Latin name	Morphological Features	Localization in a human body	Parasite Life Cycle	Preventive Measures
1.Ancylostomiasis, Hookworm Ancylostoma duodenale				
2. Strongyloidiasis, Intestinal dwarf Threadworm Strongiloides stercoralis				
3.Dracunculosis Guinea worm (Rishta)				

Chart 2

Human Parasitic Filariae

Pathogen	Disease	Vector	Localization in the Human Body	Diagnostics
Wuchereria bancrofti				
Loa loa				
Onchocerca volvulus				
Brugia malayi				

2. Helmintho-ovoscopy - laboratory microscopy of helminthological material

2.1. Manual for helminthoscopy and helmintho- ovoscopy:

1. Microscopy is performed at mag. 7x8 in a slightly darkened field, at mag. 7x40 -for the differential diagnosis of larvae and eggs.
2. To count the eggs, the tools and counting chamber are required.
3. The necessary dishes (test tubes, pipettes, glasses) are preliminarily subjected to laboratory processing.

4. At the end of the study, the dishes and the workplace are processed, and the dishes are placed in a 5-10% carbolic acid solution for 5-6 hours.

2.2. QUALITATIVE HELMINTO-OVOSCOPY METHODS

1. Native smear	Grind a piece of feces on a glass slide in a drop of 50% glycerol solution
2. Thick smear (Kato test)	A grain of feces on a glass slide is covered with a cellophane plate moistened with water, and rubbed with another glass slide, the preparation is dried in a cupboard at 40º.
3. Fullebourne	The method is based on the property of eggs to float. One part of the feces is mixed with 20 parts of a saturated Nacl solution.
4. Sedimentation	20-30 g of feces is mixed with 250 g of water, stirred, filtered, settled for 30 minutes, the sediment is examined under a microscope.
5. Sticky tape	A sticky tape is fixed on a glass stick, touched to the perianal region, the tape is placed with the sticky side on a glass slide.

3. At mag. 7x8 study permanent preparations of a mixture of eggs of flat and roundworms - human parasites. Fill in the Chart 3 specific morphological features and size of parasitic worm eggs.

Chart 3

Morphological Features of Parasitic Worm Eggs.

Helminth	Morphological Features of Eggs	Appearance and size
1. Liver fluke		
2. Cat Fluke		
3. Blood Shistosoma		
4. Broad Tapeworm		
5. Human Ascaris		
6. Pinworm		
7. Whipworm		
8. Hookworm		

Abstract of the Theme.

BASIC DEFINITIONS:

Ancylostomiasis-

Brugiosis-

Wuchereriasis-

Helminthoscop

Helmintho-Ovoscopy

Dracunculosis-

Microfilaria-

Onchocerciasis-

Rhabditiform larva-

Strongyloidiasis-

Filariform larva-

Elephantiasis-

Loiasis-

Filariasis-

NECESSARY SKILLS:
1.To microscopy parasitological material for the diagnosis of helminths.
2.To process laboratory glassware before and after parasitological examination of the material.

Student_____ Teacher_____

«____»_____201_.

LESSON No 26

THEME: Parasitic Arthropods. Arachnides, their Morphological Characteristics. The Role of Ticks in the Transmission of Infectious and Parasitic Diseases in Humans. Poisonous Arachnids.
AIM: To study the morphological features and the role of arachnids in the spread of human parasitic diseases.

INDEPENDENT WORK:
1. Structural characteristics and organization of representatives of the type Arthropoda.
2. Morphological features and life cycles of the Class Arachnida (spiders, scorpions, ticks).
3. The role of arachnids in the spread of parasitic and vector-borne diseases.
4. The doctrine of Academician V.N. Pavlovsky on the natural foci of vector-borne diseases.
5. Poisonous Arachnids.

CLASSWORK:

1. **Type Arthropods – Ph. Arthropoda.**
   Subtype Chelicerae– Subph. Chelicerata.

Class Arachnids – Classis Arachnoidea.
Order Ticks – Ordo Acarina.

1.1. Family Ixodic Ticks – Familia Ixodidae.

а) Dog tick *(*Ixodes ricinus) – a pathogen of _____.

б) Taiga tick (Ixodes persulcatus) – a pathogen of _____.

Under a magnifier study a larva, nymph, adult dog tick - as a vector of encephalitis and tularemia pathogens . Indicate morphological features (chelicera, pedipalps, spiracles, dorsal shield, anus, genital opening).

Fill in the Chart 1 main morphological features of the family and individual species of ticks

1._____2._____3._____4._____5._____

Fig. 1. Adult ixodic tick Mag. 7x8

Fig. 2. Ixodic tick larva Mag. 7x8

Fig.3. Ixodic tick nymph Mag. 7x8

1.2.Family Argasid Ticks – Fam. Argasidae.

Under a magnifier study and fill in the Chart 1 the morphological features of a village tick - a vector of spirochetes, spirochete is a pathogen of tick-borne relapsing fever.

1.3 Family Acariformes– Fam. Acariformes.

Study at mag. 7x8 and sketch the morphological features of a Scabies tick - Sarcoptes scabiei – a pathogen of scabies (scabiosis) in humans. Fill in the Chart 1 basic characteristics of the family and species. Indicate on the Fig: chelicerae, pedipalps, walking legs, oral apparatus.

1._____

2._____

3._____

4._____

Fig. 5. _____

INDEPENDENT WORK. Fill in the Chart 1 basic morphological differential features of Ixodic, Argasid and Acari form ticks.

Chart 1

Type Arthropods – Class Arachnids

Representative, English and Latin name	**Morphological features**	**Transmitted pathogen**
1. Dog tick _____ _____		
2. Taiga tick _____ _____		
3. Village tick _____ _____		
4. Scabies tick _____ _____		

. 2. **Poisonous Arthropods – *Ph. Arthropoda.***

Analyze the morphological features of poisonous arachnids and insects (scorpions, spiders, wasps, bees), the poisoning mechanism and the principles of first aid for victims.

Effects of animal poisons on the human body and first aid for bites.

Poisonous animals	**How poison works**
1.Scoppions	Poisons of neurotoxic action, affect membrane potentials, sodium channels in the nervous and inter-neuronal synapses. Inhibitors of protein enzymes.
2.Karakurt	The poison causes tissue necrosis at the site of injury. The central and peripheral parts of the autonomic nervous system are affected.
3.Bee	Bee venom is complex in composition (proteins, amino acids, enzymes, salts, hydrochloric acid, etc.). The effect of bee venom on the human body is complex. It depends on the dose of poison, the place of sting and sensibility of the human. Bee venom has a local and general effect as a therapeutic agent.
4.Wasp	The effect of poison is usually local. Allergic reactions are possible . Reactions to sting develop rapidly and can cause death.

Symptoms	First Aid
Scorpion: At the site of the bite, edema, drowsiness, headache, chills, temperature reaction, cough, increased breathing, and sometimes vomiting.	Lubricate the lesion site with vegetable oil, applying a warm heating pad
The bite of the **female karakurt** is painful, the local reaction is almost not expressed, the general toxic effects develop in 10-30 minutes. Severe muscle pain, agitation, fear of death, dry tongue, temperature reaction.	Give an abundant hot drink, warm the body and limbs with heaters. Then the most effective treatment is antitoxic serum.
Bee: Local pain and inflammatory reaction: burning and pain, swelling, weak general toxic effects - nausea, chills, dry mouth **Wasp:** The overall reaction may be in the form of rash, anaphylactic shock, asphyxia, bronchospasm.	Remove the sting of a bee from the wound, smear the place of damage with alcohol (cologne), apply cold, administer Dimedrol or Pipolfen. In case of an allergic reaction, depending on the symptom, administer suprastin, diphenhydramine, pipolfen with analgin (antihistamines).

Abstract of the Theme.

BASIC DEFINITIONS:

Actively poisonous animals-

Imago-

Larva of the representatives of Ticks-

Passive-poisonous animals-

Pedipalps-

Chelicerae-

Dorsal shield-

Vector-borne diseases-

Transovarial transmission of the pathogen-

Poisonous Arachnids-

NECESSARY SKILLS:

1. To identify the different stages of development of ixodic ticks (larva, nymph, adult) according to morphological characteristics..
2. To identify the representatives of the family Acariform ticks (scabies itch).
3. To perform personal and public prevention of tick infection.

Student_____ Teacher_____

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LESSON No 27

THEME: Insects - Ectoparasites and Vectors of Human Vector-borne Diseases. Order Diptera - Vectors of Human Vector-borne Diseases.

AIM: To study the morphological features of insects, to determine their role in the spread of vector-borne diseases and in human parasitism. To study control measures for harmful insects. To study morphological characteristics of representatives of the Order Diptera - vectors of malaria, typhoid fever, cholera, tularemia, leishmaniasis, filariasis pathogens, as well as cysts of Protozoa and eggs of parasitic worms; control and protective measures.

INDEPENDENT WORK:

1. Morphological characteristics of insects.
2. Morphological features of lice and vector mechanisms of rash and relapsing fever pathogens. Pediculosis control measures.
3. Morphological features of bedbugs, fleas, ants, roaches, their role as vectors of parasitic disease pathogens.
4. Morphological features of dipterous insects (mosquitoes, horseflies, gadflies, midges) their role in the transmission of pathogens of vector-borne and parasitic diseases.
5. Methods of fighting the midges.

CLASSWORK:

1. **Type Arhropods – Ph. Arthropoda.**
   Subtype Tracheal – Subph. Tracheata.
   Class Insects – Cl. Insecta.

1.1. Order Lice – Ordo Anoplura.

Under the magnifier view preparations of lice:

1. Head louse (Pediculus humanus capitis) – a vector of the pathogen of _____ .

2. Body louse (Pediculus humanus humanus (P. vestimenti)) – a vector of the pathogen of

_____

3. Pubic louse (Phtirus pubis) – _____

Draw and designate the morphological features of lice: head, chest, abdomen, limbs, antennae, stigma.

1._____2._____3._____

4._____5._____6._____

Fig. 1. _Head Louse Fig. 2. _ Body Louse Fig. 3. _ Pubic Louse

1.2. Order Fleas – Ordo Aphaniptera.

Under the magnifier view the preparation of a blood-sucking ectoparasite- **Human Flea *(*Pulex irritans) – a vector of the pathogen of** _____

Draw and designate morphological features: head, oral apparatus, jumping limbs, abdomen.

1._____

2._____

3._____

4._____

Fig. 4. _____

1.3. **Order Bed bugs – Ordo Heteroptera**.

Under the magnifier view the preparation of a **bed bug (Cimex lectularius) – ectoparasite** _____

Draw and designate morphological features of the bed bug: stitching-sucking mouth apparatus, head, chest, segmented abdomen, limbs.

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

Fig. 5. _____

INDEPENDENT WORK. Fill in the Chart 1.

Chart 1

Morphological characteristics of lice, fleas, bed bugs, their role as vectors of human pathogens

Russian and Latin Name	Morphology of the Imago	Metamorphosis Stages	Pathogen transmitted	Localization in the human body
1. Head louse _____ _____				
2. Body louse _____ _____				
3.Pubic louse _____ _____				
4. Flea _____ _____				
5. Bed bug _____ _____				
6. Kiss bug _____ _____				

2. Order Dipterous – Ordo Diptera

2.1 Family Moth (Drain) fly – Fam. Psychodidae

View the preparation of a mosquito (Phlebotomus pappatasii) - a vector of the pathogen of fever pappatachi, microfilariae, cutaneous and visceral leishmaniasis; sketch and designate morphological features: head, chest, abdomen, antennae, oral apparatus, wings, limbs.

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

Fig. 1. _____

2.2. Family Mosquitoes – Fam. Culicidae.

Under the magnifier view preparations of larvae, nympths and imago of the **Malaria mosquito (Anopheles maculipennis*)* and Common house mosquito (Culex pipiens)**. Fill in the Chart 2 their distinguishing characteristics.

2.3. **Family Flies – Fam. Muscidae**.

View the pictures:

a) Housefly (Musca domestica) – a vector of the pathogen of _____;

б) Wohlfart fly (Wohlfahrtia magnifica) – a pathogen of _____;
в) Autumn fly (Stomoxis calcitrans) – a vector of the pathogen of _____;
г) Tse-tse fly (Glossina palpalis) – a vector of the pathogen of _____.

Chart 2

Characteristics of malaria and common house mosquitoes at different stages of development

Stage	Characters	Malaria Mosquito (Anopheles)	Common house Mosquito (Culex)
Imago	Female palpi		
	Male palpi		
	Spots on the wings		
	Landing on the body		
Eggs	Lateral chambers (floats)		
	Laying eggs		
Larvae	Respiratory siphon		
	Location in the water		
Nymphs	Respiratory tubes		

Abstract of the Theme

BASIC DEFINITIONS:

Nits-

Midges-

Dermatobiosis-

Insecticides-

Imago-

Myiasis-

Pediculosis-

Pubic louse-

Rickettsia-

Phthiriasis-

NECESSARY SKILLS:

1. To identify larvae, pupae and adults of mosquitoes Anopheles and Culex according to morphological characteristics .
2. To provide personal and socia protection against bloodsucking insects.
3. To identify lice, bugs and fleas in preparations.
4. To perform personal and social prevention of Pediculosis.
5. To distinguish flies - carriers and pathogens of human diseases by morphological characteristics.

Student_____ Teacher_____

«____»_____201_.

LESSON 28

THEME: Modern problems of human ecology (seminar). The final lesson of the "Parasitology".

AIM: To study the main global and regional environmental problems. To determine the role of anthropogenic impact on the environment nowadays. To study international and state documents on the environment protection

To check up students knowledge in the section “PARASITOLOGY”.

For macro- and micropreparations, to perform a practical diagnostics of parasitic Protozoa, flatworms and roundworms, arthropods (arachnids, insects).

INDEPENDENT WORK

1. Biosphere -
2. The author of Biosphere conception-
3. Heterotrophic organisms-
4. Abiotic factors-
5. Biotic factors-
6. Biogeocenosis-
7. Mutualism-
8. Parsitism-
9. Biohelminths-
10. Geohelmints-
11. Definitive Host-
12. Intrmediate Host-
13. Invasive Stage of a Parasite-
14. Ectoparasites-
15. Medical Parasitology studies-
16. Invasive Stage of a Dysentery Amoeba-
17. Pathogen Form Enatamoeba histolytica –
18. The diagnosis of amoebiasis is established upon detection
19. Infection with amoebiasis occurs
20. The pathogen of African sleeping sickness
21. Vector Trypanosoma brucei gambiense
22. Trypanosome in the human body is localized
23. The diagnosis of human trypanosomiasis is established
24. Leishmania tropica parasitizes in
25. Leishmania donovani causes in humans

26. The vector of Leishmania is
27. Trichomonas vaginalis in humans causes
28. Diagnosis of giardiasis in humans is carried out
29. Human infection with giardiasis occurs
30. Toxoplasma gondii in humans causes
31. Human infection with toxoplasmosis occurs
32. The pathogen of 4-day malaria is
33. Human infection with malaria occurs when
34. The stage of malarial plasmodium invasive for humans
35. The invasive stage of malaria plasmodium for humans is
36. The main host of Plasmodium malaria is
37. Diagnostics of malaria is carried out
38. To prevent malaria infection, it is necessary
39. Parasitic infusoria for humans are
40. Fasciola hepatica in humans parasitizes in
41. A person becomes infected with fascioliasis when
42. The invasive stage of Fasciola hepatica in humans is
43. The intermediate host of the hepatic fluke is
44. Diagnosis of fascioliasis in humans is carried out
45. Prevention of fascioliasis includes
46. A person becomes infected with opisthorchiasis
47. The invasive stage of the feline fluke for humans is called
48. Diagnosis of opisthorchiasis in humans is carried out
49. Prevention of human infection with opisthorchiasis includes
50. A Pathogen of urogenital schistosomiasis
51. To detect Schistosoma haemotobium in humans, examine
52. Infection of a person with paragonimiasis occurs when
53. Paragonimus ringeri in humans parasitizes
54. Diagnosis of paragonimiasis in humans is carried out
55. Prevention of paragonimiasis is
56. Tapeworms lack organ systems
57. Finna of the pork tapeworm is called
58. Bull tapeworm Finna is called
59. Finna of the dwarf tapeworm is called
60. Finna of the broad tapeworm is called
61. Cysticercosis in humans is possible with infection
62. A mature segment of Taenia solium has branches of the uterus
63. The definitive host of the armed tapeworm is
64. Intermediate host of the armed tapeworm
65. Diagnosis of teniasis is carried out
66. Prevention of human teniasis includes
67. Teniarinchiasis in humans is caused
68. Infection of a person with teniarinhoses occurs when
69. The intermediate host of the unarmed tapeworm is
70. The definitive host of the bull tapeworm is
71. Diagnosis of teniarinchosis is
72. The number of uterine branches in a mature segment of an unarmed tapeworm is
73. Prevention of teniarhynchiasis includes
74. Hymenolepiasis is a disease caused by
75. Dwarf tapeworm is localized in humans

76. Human infection with hymenolepiasis occurs
77. Diagnosis of hymenolepiasis is carried out
78. Prevention of human infection with hymenolepiasis includes
79. A person becomes infected with echonococcosis when
80. The definitive host of echinococcus is
81. The intermediate host of echinococcus can be
82. Diagnosis of echinococcosis in humans
83. Prevention of echinococcosis is
84. Broad tapeworm causes disease
85. The invasive stage of the broad tapeworm for humans is
86. Organs of attachment of a broad tapeworm in the human intestine
87. A person becomes infected with diphyllobothriasis
88. The intermediate hosts of the broad tapeworm are
89. Diagnosis of diphyllobothriasis is
90. Prevention of diphyllobothriasis includes
91. Place of localization of a wide tapeworm in humans
92. The size of human ascaris is
93. Localization of sexually mature ascaris in the human body
94. Infection of a person with ascariasis occurs when
95. Diagnosis of ascariasis is
96. Prevention of ascariasis includes
97. Vlasoglav parasitizes a person in
98. Vlasoglav is fed
99. The conditions necessary for the maturation of whipworm eggs are
100. Life span of a whipworm
101. A person becomes infected with trichocephalosis
102. Diagnostics of trichocephalosis
103. Prevention of trichocephalosis includes
104. Pinworm Causes Disease
105. Place of localization of pinworms in humans
106. The size of the pinworm is
107. Diagnosis of enterobiasis is carried out
108. Prevention of enterobiasis includes
109. Ankylostomiasis causes
110. Dimensions of hookworm
111. The invasive stage of the duodenal hookworm for humans is
112. Infection of a person with hookworm infection occurs when
113. Localization of hookworms in humans
114. Diagnosis of ankylostomiasis is carried out
115. Prevention of hookworm infection includes measures
116. Necator americanus is morphologically similar to
117. Morphological differences between hookworm and nekator are
118. Strongyloides stercoralis in the human body is localized in
119. The size of intestinal worm is
120. Infection of a person with strongyloidosis occurs
121. A person becomes infected with Trichinosis
122. Sexually mature Trichinella in humans are localized
123. Larvae of Trichinella are localized
124. Diagnosis of trichinosis is carried out
125. Prevention of trichinosis includes

126. Dracunculiasis causes a parasite in humans
127. Rishta is localized in humans
128. A person becomes infected with dracunculiasis when
129. Diagnosis of dracunculiasis is carried out
130. Prevention of dracunculiasis includes
131. For pathogens of filariasis, the final owner is
132. Carriers of filariae are
133. The carrier of the causative agent of wuchereriosis is
134. The carrier of the loiasis pathogen is
135. The carrier of the pathogen of brugiosis is
136. The carrier of the causative agent of onchocerciasis is
137. Prevention of wuchereriasis consists in
138. Prevention of loiasis consists in
139. Prevention of brugiasis consists in
140. Prevention of onchocerciasis is
141. Diagnosis of filariasis includes
142. Biohelminths include
143. Geohelminths include
144. Prevention of filariasis is based on
145. Crustaceans, which are the intermediate owners of rishta
146. Crabs are intermediate hosts
147. Poisonous arachnids for humans are
148. Chelicerae of arthropods are
149. The number of walking legs in arachnids is
150. Sexual dimorphism in ticks is manifested
151. Tick larva differs from nymph
152. The tick larva differs from the imago
153. Tick nymph differs from imago
154. The Acarus siro mite is localized
155. The scabies is diagnosed by
156. Human infection with scabies occurs when
157. In insects, the number of walking legs is
158. Transovarian transmission of the pathogen means
159. Pediculosis is
160. The head louse is a carrier of the pathogen
161. The body louse is a carrier of the pathogen
162. Human infection with typhus occurs when
163. Infection of a person with relapsing fever occurs when
164. Fleas are carriers of the pathogen
165. Carriers of the causative agent of malaria are
166. Vile is
167. Mosquitoes are carriers of pathogens
168. Housefly can be a carrier of pathogens
169. Miaz is
170. Actively poisonous animals are
171. Passive-poisonous animals are
172. Ectoparasitism is
173. Endoparasitism is