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MEDICAL BIOLOGY

PRACTICAL BOOK

FOR INTERNATIONAL STUDENTS 1ST YEAR STUDING DENTISTRY

Minsk BSMU 2016

МИНИСТЕРСТВО ЗДРАВООХРАНЕНИЯ РЕСПУБЛИКИ БЕЛАРУСЬ
БЕЛОРУССКИЙ ГОСУДАРСТВЕННЫЙ МЕДИЦИНСКИЙ УНИВЕРСИТЕТ
КАФЕДРА БИОЛОГИИ

В. Э. БУТВИЛОВСКИЙ, А. В. БУТВИЛОВСКИЙ, Е. А. ЧЕРНОУС

МЕДИЦИНСКАЯ БИОЛОГИЯ

MEDICAL BIOLOGY

Практикум
для иностранных студентов 1-го года обучения по специальности «Стоматология»

3-е издание, исправленное



Минск БГМУ 2016

УДК 57(811.111)-054.6(076.5) (075.8)

ББК 28.70 (81.2 Англ-923)

М42

Рекомендовано Научно-методическим советом университета в качестве практикума 16.03.2016 г., протокол № 7

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М42 Медицинская биология = Medical biology : практикум для иностр. студ. 1-го года обучения по спец. «Стоматология» / В. Э. Бутвиловский, А. В. Бутвиловский, Е. А. Черноус. – 3-е изд., испр. – Минск : БГМУ, 2016. – 110 с.

ISBN 978-985-567-464-2.

В издание включены основные термины и понятия, закрытые и открытые тесты для самоконтроля, тексты задач по цитологии, генетике, паразитологии и эволюции систем органов хордовых животных, схемы и контуры рисунков, оригинальные фотографии изучаемых препаратов, контрольные и экзаменационные вопросы. Первое издание вышло в 2014 году.

Предназначено для студентов 1-го курса медицинского факультета иностранных учащихся, обучающихся на английском языке по специальности «Стоматология»

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Current marks

of the student _____ (I semester)

No№	Topic of practice	mark	Teacher's signature
1.	Human in the system of nature. Methods of studying cells		
2.	Biology of the cell. The flow of substance in the cell. The flow of energy in the cell		
3.	Temporal organization of the cell		
4.	Organization of hereditary material (I)		
5.	Organization of hereditary material (II)		
6.	Genetic engineering		
7.	Control practice in cytology and molecular biology		
8.	Inheritance regularities. Interaction of genes		
9.	Genetic linkage		
10.	Variation		
11.	Biology and genetics of sex		
12.	Fundamentals of human genetics (I)		
13.	Fundamentals of human genetics (II)		
14.	Control practice in genetics		
15.	Human genetic and chromosomal diseases		
16.	Genetic counseling		
17.	Reproduction of organisms		
18.	Fundamentals of ontogenesis (embryonic development)		
19.	Fundamentals of ontogenesis (embryonic post-embryonic development)		

Current marks

of the student _____ (II semester)

№№	Topic of practice	mark	Teacher's signature
1.	Introduction to parasitology. Phylum Infusoria. Class Ciliata		
2.	Phylum Apicomplexa. Class Sporozoa		
3.	Phylum Plathelminthes. Class Trematoda		
4.	Phylum Plathelminthes. Class Cestoidea		
5.	Phylum Nematelminthes. Class Nematoda		
6.	Phylum Arthropoda. Class Arachnoidea. Venomous animals		
7.	Phylum Arthropoda. Class Insecta		
8.	Diagnosis of parasitic preparations. Control practice in parasitology		
9.	Evolution of organ systems		

DEMANDS OF THE BIOLOGY DEPARTMENT TO THE STUDENTS:

1. **Observe the safety rules in the classrooms of the department** (the safety instructions have been carried out), obey internal regulations of the Belarusian State Medical University.
2. Do not come late for practical classes. Students who are late for practical classes **are not admitted**.
3. Students **must have gowns, practical books, pencils** for practical trainings. Students **who** do not have gowns and practical books **are not admitted** to the practical classes.
4. Missed classes must be fulfilled within **2 weeks**.
5. Students who have not fulfilled the missed practical classes within 2 weeks **are not admitted** to the further classes, summary classes, credit and the examination without dean's permission.
6. Students with result marks for the year **lower than 4.0** who got a **poor mark at the examination can retake the examination only at the end of August**.
7. Students with **average of all** marks (except summary classes) for the year **8,25 and higher** (under condition that they pass **all** final classes with the marks "8", "9" and "10") may **be examined only for micropreparations and problems**. If the task is done successfully they obtain a "ten".

I have read the demands of the department: _____201_____ (signature)

Practice.1 (20). Topic: **INTRODUCTION TO PARASITOLOGY PHYLUM INFUSORIA. CLASS CILIATA.** "___" _____201 г

Purpose of the practice: to study and to know the forms of biotic relations; to consider parasitism as a biologic phenomenon; to study classification of parasites and their hosts, adaptation of parasites, their pathogenic action and responses of their hosts; to study biological morphological peculiarities and of parasites of the class Ciliata, their pathogenic action; methods of diagnostics and prevention of diseases they cause.

<p style="text-align: center;">CONTROL QUESTIONS</p> <ol style="list-style-type: none"> 1. Origin of parasitism. Criteria of parasitism. 2. Classification of parasites and their hosts. 3. Rotes of transmission of parasites. 4. Morphophysiological and biological adaptations of parasites. 5. Pathogenic action and specificity of parasites. 6. Host's response to parasitic invasion. 7. Biological basis of prophylaxis of parasitic diseases. 8. Balantidium: morphological peculiarities, life cycle, rotes of transmission, pathogenic action; characteristic symptoms, diagnosis and prophylaxis of balantidiasis. 	<ol style="list-style-type: none"> 5. True parasites – 6. Criteria of parasitism – 7. Pathogenicity – 8. Parasite –
<p style="text-align: center;">BASIC TERMS AND CONCEPTS</p> <ol style="list-style-type: none"> 1. Anthroponoses – 2. Invasive diseases – 3. Hyperparasitism – 4. Zoonoses – 	<ol style="list-style-type: none"> 9. Parasitism – 10. Specificity of the parasite – 11. Invasive stage –

TESTS FOR SELF-CONTROL

- 1. Characteristic of parasitism:** a) both organisms receive benefit; b) the individual of one species uses the individual of another species only as habitation; c) the individual of one species uses the individual of another species as habitation and the source of nutrition, not causing any harm; d) the individual of one species uses the individual of other species as habitation and the source of nutrition and harms it; e) none of the organisms receive any benefit.
- 2. Examples progressive morpho-physiological adaptations of parasites:** a) the presence of attachment organs and specialized body integument; b) simplification of the nervous system and sense organs; c) molecular mimicry and secretion of anti-enzymes; d) reduction of the alimentary system; e) high fertility and complex life cycles.
- 3. Examples of biological adaptations of parasites:** a) presence of attachment organs and anti-enzymes; b) simplification of the nervous system and sense organs; c) various forms of asexual reproduction and high fertility; d) complex life cycles, alternation of hosts and migration of larvae over the organism of the host; e) immunosuppressive action.
- 4. Pathogenic action of the parasite:** a) mechanical injury of tissues, toxicallergic; b) supplying the host with vitamins; c) supplying the host with nutrients; d) absorption of nutrients and vitamins from the host; e) weakening the organism and increasing probability of secondary infection.
- 5. Pathogenicity of a parasite does not depend on:** a) host's genotype and environmental factors; b) parasite's genotype and virulence ; c) host's age and diet; d) body height and a sex of the host; e) presence of other parasites in the host.
- 6. Protective reactions of the host's organism occur at levels:** a) subcellular and cellular; b) cellular and organism; c) specific and tissue; d) cellular and tissue; e) population-specific.
- 7. Adaptation of parasites at the population level:** a) presence of cysts and active searching for hosts; b) simplification of nervous system and reduction of alimentary system in tapeworms; c) molecular mimicry and anti-enzymes; d) involving of intermediate and reservoir hosts into the life cycle; e) synchronization of parasite's life cycle and hosts behavior.

Fill in the gaps:

1. Free-living organisms which can become parasites when they get to the organism of other species are called ...
2. Hosts providing optimal biochemical conditions for the parasite and have biocoenotic contact with it are called ...
3. Hosts providing biochemical conditions for the parasite but don't have biocoenotic contact with it are called ...
4. Hosts characterized by the presence of biocoenotic contacts with parasites but absence of biochemical conditions for their development are called ...
5. Route of transmission of parasites with water and foodstuffs is called ...
6. Route of transmission of parasites through mucous membranes of respiratory pipes is called ...
7. Route of transmission of parasites with household goods is called ...
8. Route of transmission of parasites with infected donor blood is called ...

Task 1. Fill in the table.

Feature	Parasites	<i>B. coli</i>
1. Name of the disease		
2. Peculiarities of morphology		
3. Life cycle		
4. Invasive stage for human		
5. Rotes of transmission		
6. Location		
7. Pathogenic action		
8. Symptoms		
9. Laboratory diagnosis		
10. Prophylaxis		

PRACTICAL WORK
Task 2. Study the micropreparation, color the picture and make indications

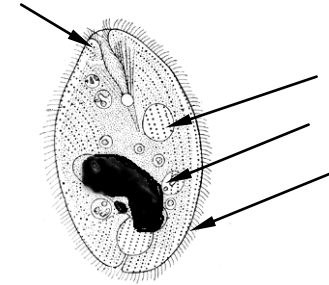


Fig.1. Balantidium

()
 1 – membrane, 2 – cytoplasm, 3 – macronucleus,
 4 – contractile vacuole

Practice 2 (21). Topic: PHYLUM SARCOMASTIGOPHORA. CLASSES SARCODINA, ZOOMASTIGOTA. PHYLUM APICOMPLEXA. CLASS SPOROZOA

"__" _____201 year

Purpose of the practice: to study peculiarities of morphology and biology of parasitic Sarcodinae, Flagellates and Sporozoans, their pathogenic action; methods of diagnostics and prevention of diseases they cause.

<p style="text-align: center;">CONTROL QUESTIONS</p> <ol style="list-style-type: none"> 1. Parasitic Sarcodinae: dysenteric amoeba, Entamoeba coli, Entamoeba gingivalis. Life cycle of the dysenteric amoeba, its pathogenic action; characteristic symptoms, diagnosis and prophylaxis of amoebiasis. 2. Parasitizing flagellates: Lamblia and Trichomonas: morphological peculiarities, life cycle, routes of transmission, pathogenic action; characteristic symptoms, diagnosis and prophylaxis. 3. Life cycle of a malaria parasite. Types of malaria parasites, their appearance in a thin blood smear. 4. Route of transmission of malaria, pathogenic action of malaria parasites; symptoms and diagnosis of malaria. 5. Toxoplasma: morphological peculiarities, life cycle, routes of transmission, pathogenic action; characteristic symptoms, diagnosis and prophylaxis of toxoplasmosis. 	<ol style="list-style-type: none"> 4. Gametogony – 5. Gamont (gametocyte) – 6. Shizont malaria – 7. Trichomoniasis – 8. Trophozoite – 9. Merozoite – 10. Merogony – 11. Ookinete – 12. Oocyst – 13. Pseudocyst – 14. Shizont – 15. True cyst –
<p style="text-align: center;">BASIC TERMS AND CONCEPTS</p> <ol style="list-style-type: none"> 1. Axostyle – 2. Amoebiasis – 3. Lambliasis – 	

TESTS FOR SELF-CONTROL

- 1. Sequence of stages of dysenteric ameba life cycle is:** a) forma minuta → forma magna → tissue form → cyst → forma magna; b) forma magna → forma minuta → tissue form → cyst → forma magna; c) cyst → forma minuta → forma magna → tissue form → forma magna; d) cyst → forma minuta → forma magna → tissue form → forma minuta → cyst; e) tissue form → forma magna → forma minuta → cyst.
- 2. Diagnostic features of lambliaiasis are:** a) bad appetite and nausea; b) headache and drowsiness; c) pains in epigastrium and in dextral subcostal area; d) pains in left subcostal area; e) unstable stool
- 3. Exoerythrocytic cycle of malaria parasites is:** a) sporozoites → erythrocytic schizont → liver-stage schizonts → liver-stage merozoites; b) sporozoites → liver-stage schizonts → erythrocytic schizonts → liver-stage merozoites; c) sporozoites → liver-stage schizonts → liver-stage merozoites; d) erythrocytic schizonts → sporozoites → gametocytes; e) sporozoites → erythrocytic schizonts → liver-stage schizonts → gametocytes.
- 4. Sequence of malaria parasite's gametogony in the human body is:** a) oocyst → gametocyte → macro- and microgametes → zygote → ookinete; b) gametocytes → macro- and microgametes → zygote → ookinete; c) macro- and microgametes → ookinete → zygote → gametocytes; d) macro- and microgametes → zygote → ookinete → gametocytes; e) gametocytes → zygote → ookinete → macro- and microgametes.
- 5. Sporogony of malaria parasite:** a) micro- and macrogametes → ookinete → oocyst → sporozoites → liver-stage merozoites; b) ookinete → oocyst → sporozoites → liver-stage merozoites; c) oocyst → sporozoites → liver-stage merozoites; d) oocyst → ookinete → sporozoites; e) oocyst → sporozoites.
- 6. Sequence of symptoms in attack of malaria is:** a) sweating stage → cold stage → hot stage; b) cold stage → sweating stage → hot stage; c) hot stage → cold stage → sweating stage; d) cold stage → hot stage → sweating stage; e) hot stage → sweating stage → cold stage.

Fill in the gaps:

1. Vegetative form of protozoans is called ...
2. "Lesion of mucous membrane of the large intestine leading to formation of bleeding ulcers 2.5 cm in diameter is a pathogenic action of ...
3. *Trichomonas vaginalis* has ... flagella.
4. Pathogen of malignant tertian malaria is Pl....
5. Pathogenic agent of quartan malaria is Pl....
6. Stage of malaria parasite that is invasive for intermediate host is called ...
7. Final stage of malaria parasite's life cycle in the human organism is called...
8. Stage of band is characteristic of Pl.... .
9. Semilunar shape of gamonts is characteristic of Pl.... .
10. Specific organelle on sharp end of toxoplasma providing the parasite fixation to the host's cell is called...
11. Principal hosts of toxoplasma are representatives of the family...
12. Life stages of toxoplasma that are invasive for the principal host are ... and ...
13. Life stages of toxoplasma that are invasive for the intermediate host are ... and...

Task 1. Fill in the table.

Feature \ Parasites	<i>E. histolytica</i>	<i>L. intestinalis</i>	<i>T. vaginalis</i>
1. Disease			
2. Peculiarities of morphology			
3. Life cycle			
4. Invasive stage for a human			
5. Rote of transmission			
6. Location			
7. Pathogenic action			
8. Symptoms			
9. Laboratory diagnosis			
10. Prophylaxis			

Fill in the table.

Feature \ Parasites	<i>Malaria plasmodia</i>	<i>T.gondii</i>
1. Disease		
2. Peculiarities of morphology		
3. Life cycle		
4. Invasive stage for a human		
5. Rote of transmission		
6. Location		
7. Pathogenic action		
8. Symptoms		
9. Laboratory diagnosis		
10. Prophylaxis		

PRACTICAL WORK

Task 1. Study the life's cycles and make the indications

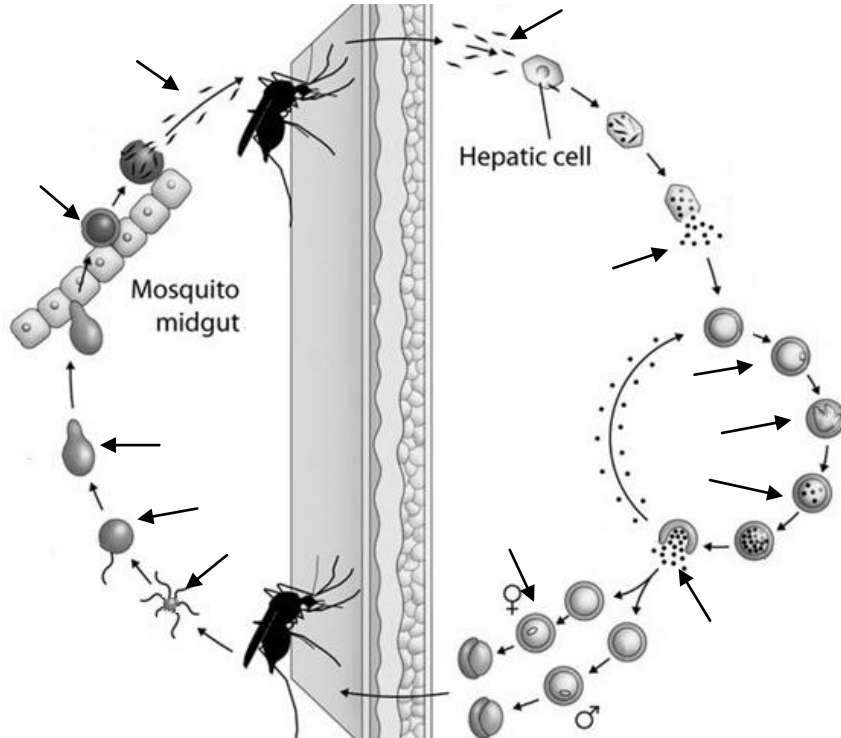


Fig.1. Life cycle of malaria parasite:

1 – sporozoites, 2 –merozoits (liver-stage), 3 – erythrocytic schizont (ring stage), 4 – ameoid schizont, 5 – morula, 6 – blood merozoites, 7 – gametocytes, 8 – macrogamete, 9 – microgamete, 10 – ookinete, 11 – oocyst.

Task II. Study the preparations, color the pictures and make indications

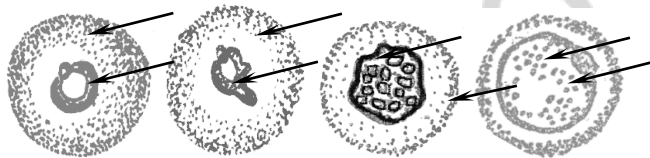


Fig.2. Sporozoite stages of *Pl. vivax* (7x90)

A – ring-stage schizont , B – ameoid schizont , C – morula, D – gamont.
1 – red blood cell, 2 – nucleus of a plasmodium, 3 – cytoplasm of plasmodium, 4 – vacuole, 5 – pseudopodium, 6 – nucleus of merozoite.

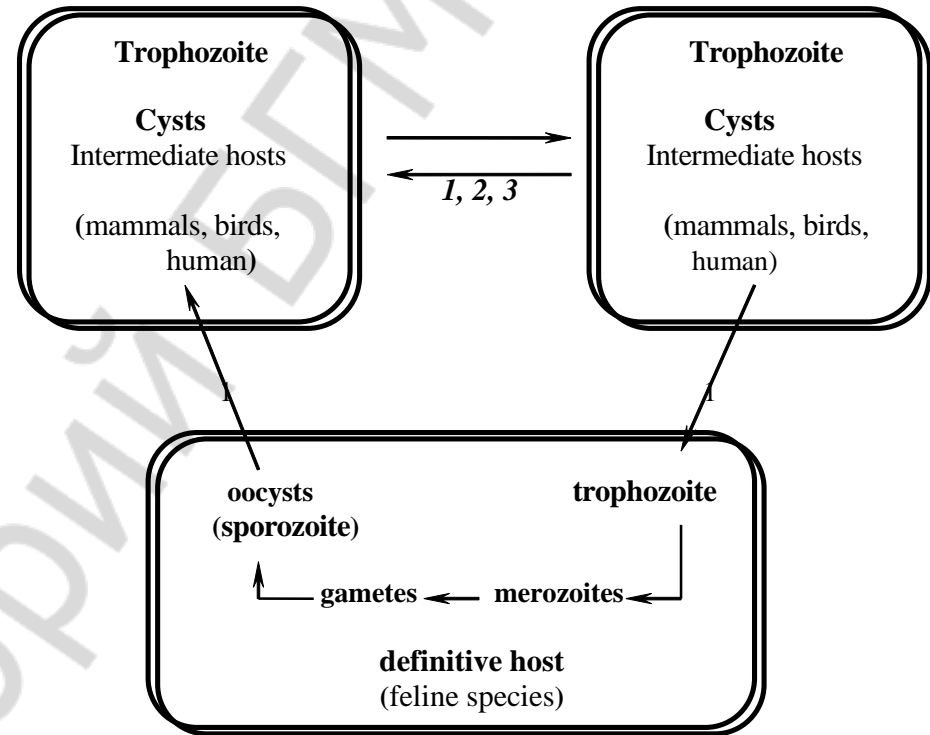


Fig. 3. Life cycle of Toxoplasma.

Infection may occur:

- 1 – alimentary way (acquired toxoplasmosis);
- 2 – through defective skin (acquired toxoplasmosis);
- 3 – a transplacental (congenital).

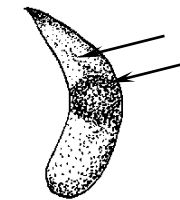


Fig. 4. Toxoplasma (7x40):

()
1 – cytoplasm, 2 – nucleus.

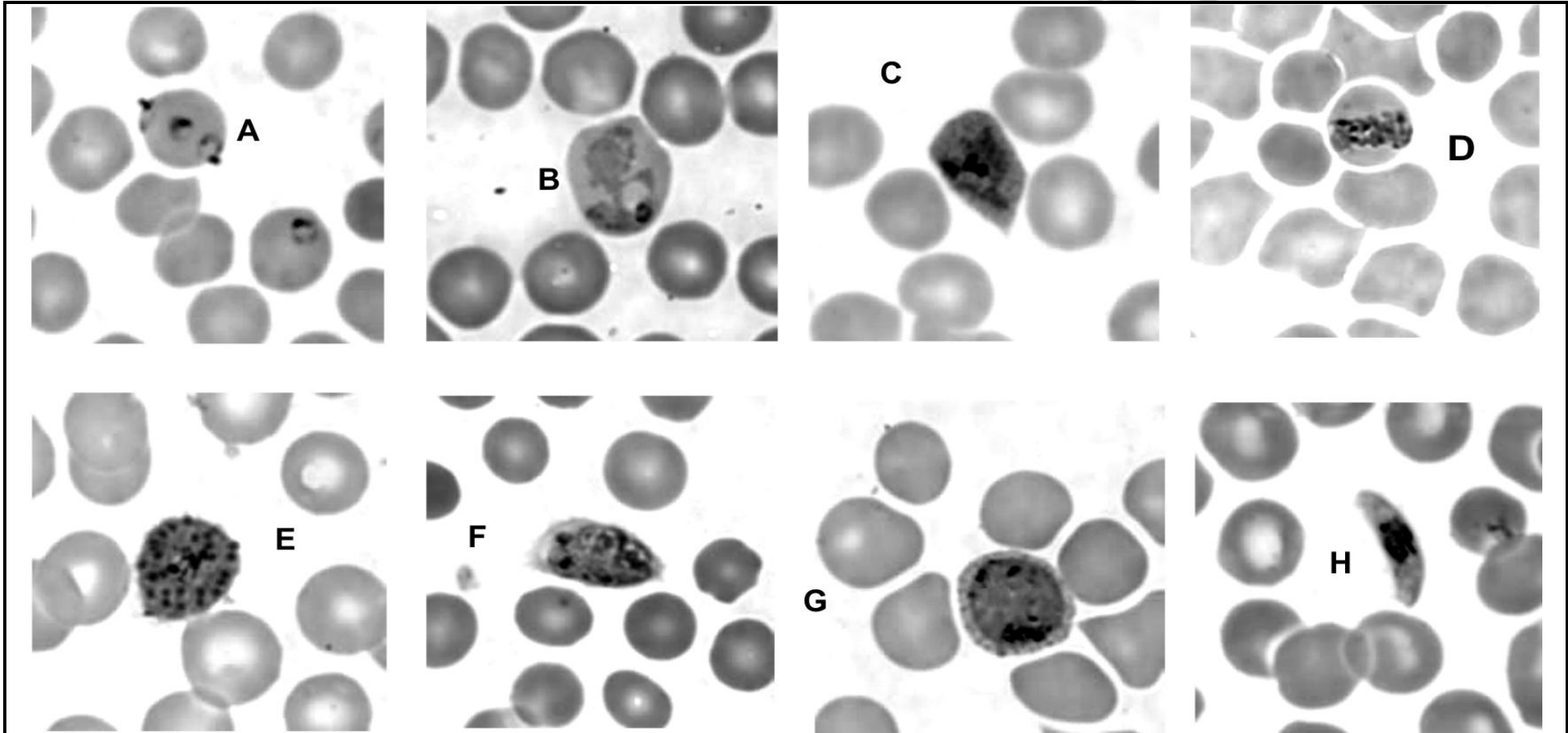


Fig5. Morphology of malaria parasites.

A – ring stage of Pl

B - ameboid schizont Pl.....,

C – schizont of Pl.....,

D – band schizont of Pl.....,

E – morula of Pl.....,

F – morula of Pl.....,

G – gametocyte Pl.....,

H – gametocyte Pl.....

Task 3. Study the micropreparations, color the pictures and make indications.

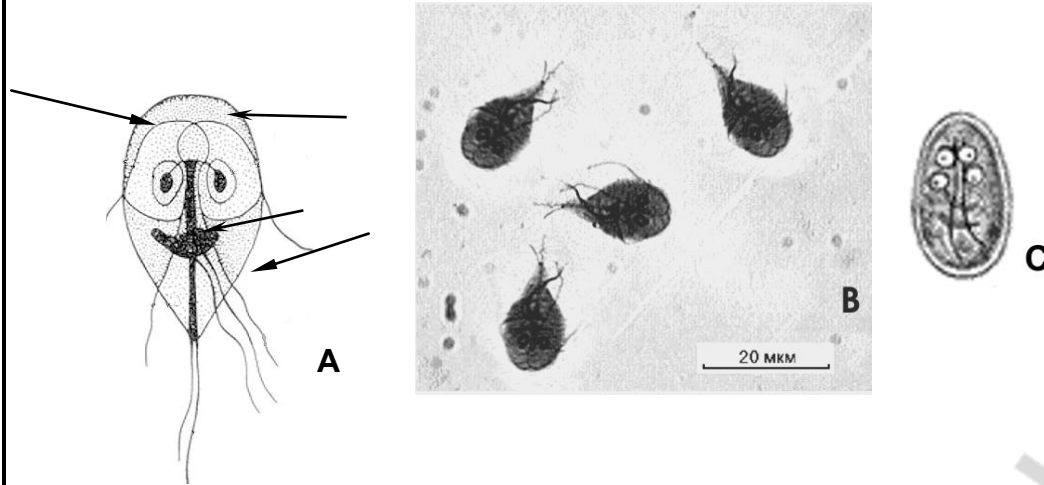


Fig. 6. Lamblia (A – scheme of trophozoite, B – trophozoites (7×40), C – cyst

()
1 – nucleus, 2 – adhesive disc, 3 – axostyle, 4 – flagella.



Fig. 7. Morphology of a Trichomonas: A – scheme, B – trophozoite (7×40)

()
1 – nucleus, 2 – undulating membrane. 3 – flagella, 4 – axostyle, 5 – spike.

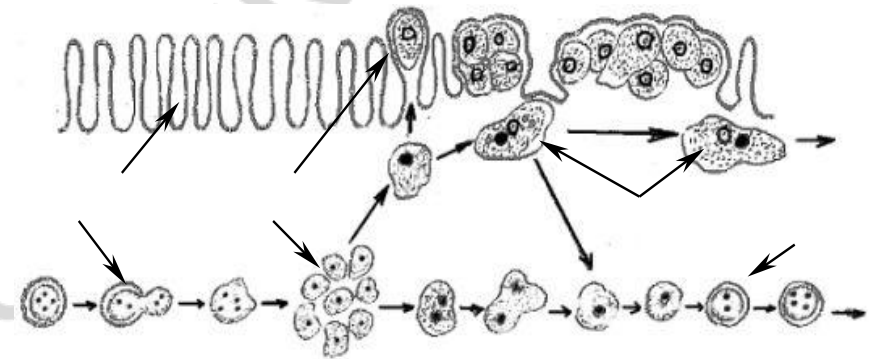


Fig. 8. Life cycle of a dysenteric ameba

()
1 - forma minuta, 2 – forma magna, 3 – tissue form,
4 – cyst, 5 – intestinal wall.

Teacher's signature

Practice 3 (22). Topic: **PHYLUM PLATHELMINTHES. CLASS TREMATODA**

"____" _____ 201____ year

Purpose of the practice: to study features of plathelminthes, their adaptations to the parasitic way of living, peculiarities of morphology and biology of flukes; routes of transmission, methods of diagnostics and precautions of trematodoses.

<p style="text-align: center;">CONTROL QUESTIONS</p> <ol style="list-style-type: none">1. General characteristic and systematics of the phylum Plathelminthes.2. Progressive adaptations of flukes to parasitic life.3. Peculiarities of life cycles of flukes.4. Liver fluke: morphological peculiarities, life cycle, routes of transmission, pathogenic action; symptoms, diagnosis and prophylaxis of fascioliasis.5. Cat liver fluke: morphological peculiarities, life cycle, routes of transmission, pathogenic action; characteristic symptoms, diagnosis and prophylaxis of opisthorchiasis.6. Biological basis of prophylaxis of trematodoses.	<p>4. Metacercaria –</p> <p>5. Miracidium –</p> <p>6. Redia –</p>
<p style="text-align: center;">BASIC TERMS AND CONCEPTS</p> <ol style="list-style-type: none">1. Adolescaria –2. Dermo-muscular body wall –3. Marita –	<p>7. Sporocyst –</p> <p>8. Tegument –</p> <p>9. Cercaria –</p>

TESTS FOR SELF-CONTROL

1. The female **reproductive** system of flukes includes: a) testes, ovaries and uterus; b) ovaries, **viteline** glands and cirrus; c) ovaries, uterus, **viteline** glands and **seminal receptacle**; d) ovaries, **seminal ducts** and uterus; e) ootype, cirrus and **viteline** glands.
2. The first **intermediate** hosts of flukes are: a) human and monkeys; b) cattle; c) cats and dogs; d) mollusks and fish, e) fishes, shrimps and crabs.
3. The second **intermediate** hosts of flukes are: a) **sometimes absent**; b) cattle; c) wild boars, house and pigs; d) **mollusks**; e) fishes, shrimps and crabs.
4. **Laboratory diagnostics of fascioliasis**: a) finding eggs in the phlegm and urine; b) finding eggs in duodenal contents and feces; c) immunoassay; d) radionuclide diagnostics of the liver and pancreas; e) finding miracidia in excrements and duodenal content.
5. **Techniques used for laboratory diagnostics of opistorchosis**: a) Fulleborn and Kalantaryan techniques; b) Gorachev technique; c) Schulman technique; d) direct smear and thick-blood film; e) adhesive tape technique.

Fill in the gaps:

1. Metacercaria, adolescaria and cercaria of flukes are ... for the principal host.
2. Fluke which has 2 rosette-like testes and S-like canal of the excretory system between them is called...
3. Life cycle of the cat liver fluke: miracidium → egg → sporocyst → redia → ... → metacercaria.

PRACTICAL WORK

Task 1. Study the life cycle, write the principal and intermediate hosts, indicate the life stages.

- | | | | |
|----------------|---------------|-----------------|---------------|
| - adolescaria, | - miracidium, | - metacercaria, | - miracidium, |
| - redia, | - sporocyst, | - cercaria, | - egg. |

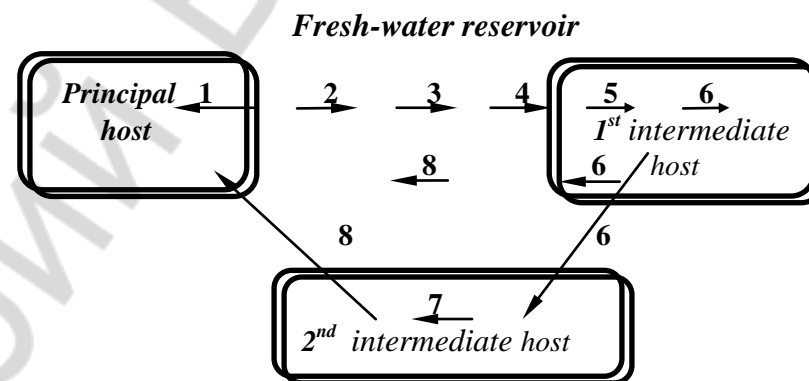


Fig.1. Life cycles of *F. hepatica* and *O. felis*.

Fill in the table:

Feature \ Parasites	<i>F. hepatica</i>	<i>O. felineus</i>
1. Disease		
2. Body size		
3. Morphology		
4. Principal hosts		
5. Intermediate hosts		
6. Life cycle		
7. Invasive stage for human		
8. Rotes of transmission		
9. Location in the human body		
10. Pathogenic action		
11. Symptoms		
12. Morphology of eggs		
13. Laboratory diagnosis		
14. Prophylaxis		

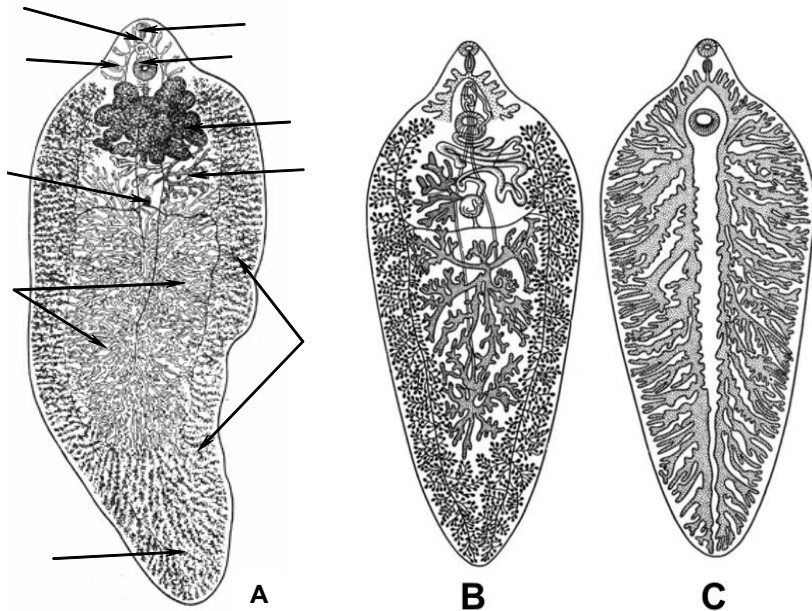


Fig.2. Liver fluke (magnifying glass)

A – scheme of parasite structure, B – structure of reproductive system, C – structure of alimentary system, 1 – oral sucker, 2 – abdominal sucker, 3 – **esophagus**, 4 – branches of gut, 5 – vitellaria, 6 – uterus, 7 – ootype, 8 – ovaria, 9 – testes, 10 – canal of excretory system.

Fig.3. Egg of a liver fluke (7x40)

1 – membrane, 2 – shell, 3 – viteline cells, 4 – tubercle.

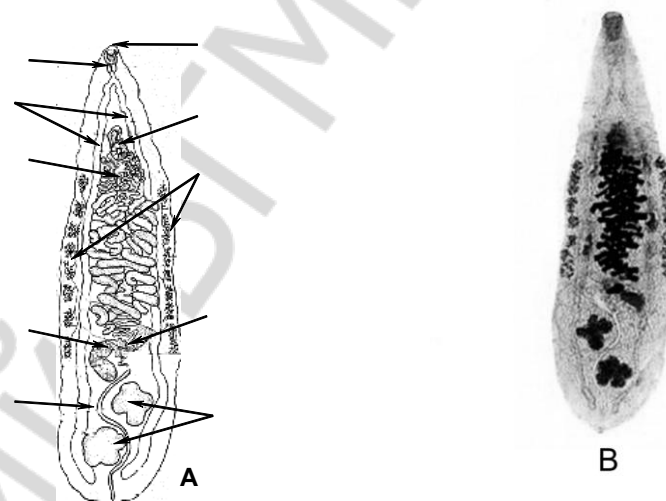
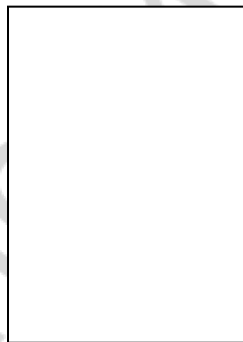
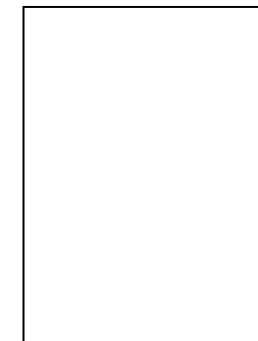


Fig.4. Cat liver fluke

()
A – scheme, B – photograph (×20),
1 – oral sucker, 2 – abdominal sucker, 3 – **esophagus**, 4 – branches of intestine, 5 – vitellaria, 6 – uterus, 7 – ovaria, 8 – seminal receptacle, 9 – testes, 10 – canal of excretory system.

Fig.5. Egg of cat liver fluke (7x40)

1 - membrane, 2 - shell, 3 - tubercle.



Teacher's signature

Practice 4 (23). Topic: **PHULUM PLATHELMINTHES. CLASS CESTOIDEA** " ___ " _____201__ year

Purpose of the practice: to study characteristic features of tapeworms and their adaptations to parasitic way of living, peculiarities of their morphology and biology, their pathogenic action, rotes of transmission, methods of diagnostics and prophylaxis of cestodoses.

<p style="text-align: center;">CONTROL QUESTIONS</p> <ol style="list-style-type: none"> 1. Characteristic of the class tapeworms, their adaptations to parasitism. Life cycles of Taeniae abd Diphyllbothria. Types of measles. 2. Taenia solium and Taeniarhynchus saginatus: morphological peculiarities, life cycle, rotes of transmission, pathogenic action; symptoms, diagnosis and prophylaxis of taeniarhynchosis and cysticerciasis. 3. Dwarf tapeworm: morphological peculiarities, life cycle, rotes of transmission, pathogenic action; characteristic symptoms, diagnosis and prophylaxis of hymenolepidosis. 4. Echinococcus and Alveococcus: morphological peculiarities, life cycle, rotes of transmission, pathogenic action; characteristic symptoms. Diagnosis and prophylaxis of echinococcosis and aleveococcosis. 5. Diphyllbothrium latum: morphological peculiarities, life cycle, rotes of transmission, pathogenic action; characteristic symptoms, diagnosis and prophylaxis of diphyllbothriosis. 6. Biological basis of prophylaxis of cestodoses. 	<ol style="list-style-type: none"> 3. Contact helminthes – 4. Plerocercoid – 5. Proglottid - 6. Scolex – 7. Strobila – 8. Cysticercus– 9. Cysticercoid –
<p style="text-align: center;">BASIC TERMS AND CONCEPTS</p> <ol style="list-style-type: none"> 1. Biohelminthes – 2. Bothria – 	

TESTS FOR SELF-CONTROL

- Correct sequence of broad tapeworm's life cycle is:** a) egg → coracidium → proceroid → oncosphere → plerocercoid; b) egg → oncosphere → meale; c) egg → coracidium → proceroid → plerocercoid; d) cercaria → coracidium → proceroid → meale; e) proceroid → metacercaria → plerocercoid.
- Invasion of a person with teniasis occurs during:** a) personal hygiene breaches; b) contacts with sick persons; c) eating undercooked beef; d) eating undercooked pork; e) eating undercooked fish, shrimps and crabs.
- Invasion of a person with cysticercosis occurs during:** a) swallowing eggs of park tapeworm; b) eating undercooked pork and beef; c) eating undercooked shrimps and crabs; d) contact with domestic pigs; e) autoinvasion in teniasis.
- Pathogenic action of *Taeniarchynchus saginatus* is:** a) lesion of the brain and a spinal cord; b) toxicoallergic; c) irritation of mucosa of the large intestine; d) irritation of mucosa of the small intestine; e) absorption of nutrients from the host's digestive tract.
- Diagnostic signs of *Taeniarchynchus* invasion are:** a) blood-containing diarrhoea; b) fever and aches in the abdomen; c) aches in the abdomen, nausea, vomiting; d) laboured breathing, aches in the thorax; e) enlargement of liver and spleen.

Fill in the gaps:

- A contact helminth of the class tapeworms is ...
- Hermaphroditic progottids of *Taeniarchynchus saginatus* have an ovarium, consisting of ... lobes.
- Mature proglottid of *Taeniarchynchus saginatus* have ... branches of the uterus.

4. Measle of a *Taenia solium* is called.

5. Mature proglottid of *Taenia solium* have... branches of the uterus.

6. Measle of a *Hymenolepis nana* is called ...

7. Strobila of a *Hymenolepis nana* consists of approximately ... proglottids.

PRACTICAL WORK

Task 1. Study the schemes and indicate the stages

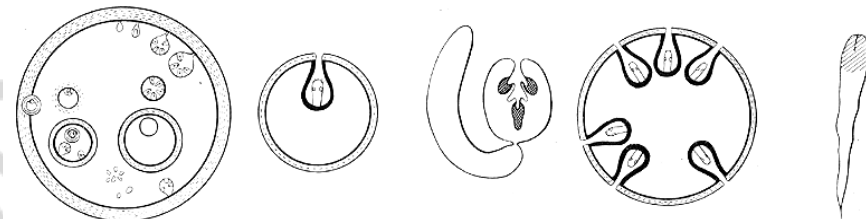


Fig.1. Types of tapeworms' measles:

1 – plerocercoid, 2 – coenurus, 3 – cysticercus, 4 – cysticeroid, 5 – echinococcus.

Task II. Study and draw the preparations and make the indications

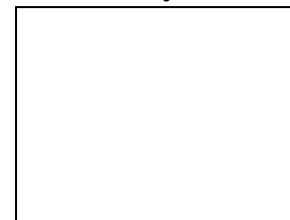


Fig.2. Egg of taenia (7x40)

1 – membrane



Fig.3. Egg of *D. latum* (7x40)

1 – head, 2 – tubercle, 3 – yolk

Fill in the table:

Feature	Parasites	<i>T.saginata</i>	<i>D. latum</i>
1. Disease			
2. Body size			
3. Morphology:			
a) scolexs			
b) proglottids			
4. Principal hosts			
5. Intermediate hosts			
6. Life cycle			
7. Rotes of transmission			
8. Location in body			
9. Pathogenic action			
10. Symptoms			
11. Morphology of eggs			
12. Laboratory diagnostics			
13. Prophylaxis			

Task III. Study the preparations, color the pictures, and make the indications.

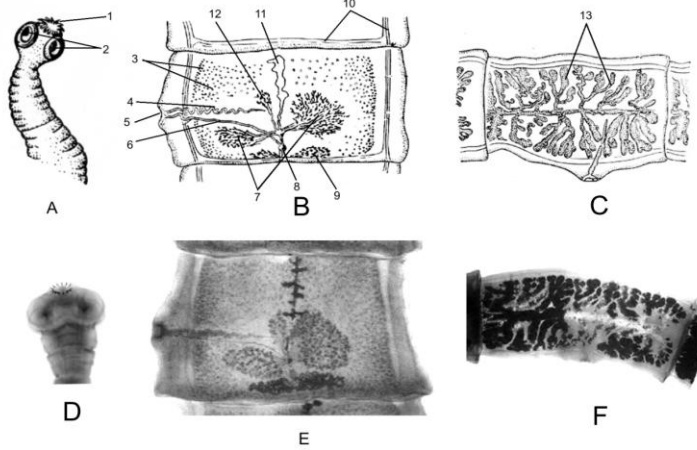


Fig.4. Taenia solium:

A-C – schemes, D-F – microphotos A, D – scolexes, B, E – hermaphroditic proglottid, C, F – mature proglottid.

- | | |
|----------|------|
| 1 – | 2 – |
| 3 – | 4 – |
| 5 – | 6 – |
| 7 – | 8 – |
| 9 – | 10 – |
| 11, 13 – | 12 – |

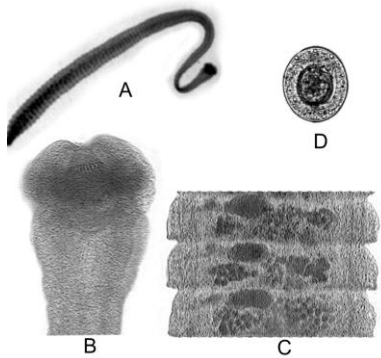


Fig.5. Hymenolepis nana:

A – tapeworm (×20), B – scolex (7×8), C – mature proglottid (7×8), D – egg (7×40)

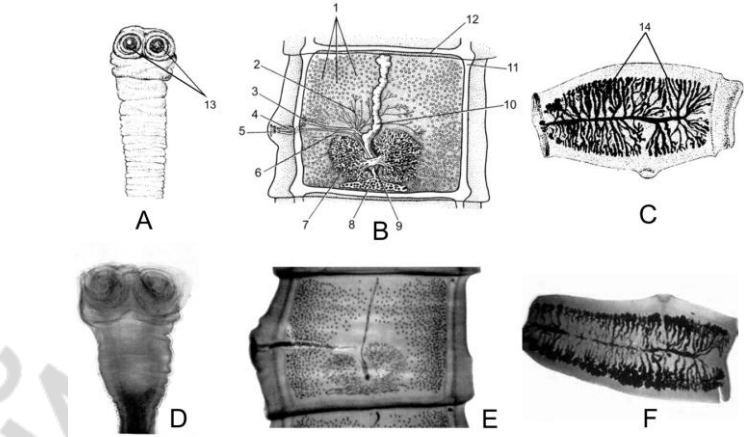


Fig. 6. Taeniarrhynchus saginatus. A-C – schemes, D-F – microphotos A, D – scolexes, B, E – hermaphroditic proglottid, C, F – mature proglottid

- | | |
|----------|----------|
| 1 – | 2, 3 – |
| 4 – | 5 – |
| 6 – | 7 – |
| 8 – | 9 – |
| 10, 14 – | 11, 12 – |
| 13 – | |

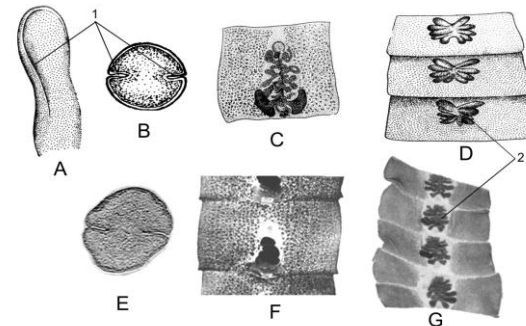


Fig. 7. Diphyllbothrium latum (schemes and microphotos):

A – scolex, B, E – scolex's transverse section, C, F – hermaphroditic proglottid, D, G – mature proglottid.

- | |
|-----|
| 1 – |
| 2 – |

Teacher's signature

Practice 5 (24). Topic: PHYLUM NEMATHELMINTHES. CLASS NEMATODA

"____" _____ 201__ year

Purpose of the practice: to study and characteristic features of the phylum Nematoda, its aromorphoses; morphological and biological peculiarities of Ascaris, whipworm, seatworm and trichinella, rotes of transmittion, pathogenic influence, ways of diagnostics and prophylaxis of nematodoses.

<p style="text-align: center;">CONTROL QUESTIONS</p> <ol style="list-style-type: none">1. General characteristic of the phylum roundworms and the class Nematoda.2. Ascaris lumbricoides and whipworm: morphological and biological peculiarities, rotes of transmission, pathogenic action symptoms of migration and intestinal stages of ascariasis, diagnosis and prophylaxis of ascariasis and trichocephaliasis.3. Seatworms: morphological and biological peculiarities, rotes of transmission, pathogenic action; characteristic symptoms, diagnosis and prophylaxis of enterobiasis.4. Trichinella: morphological and biological peculiarities, rotes of transmission, pathogenic action; characteristic symptoms, diagnosis and prophylaxis of trichinelliasis.5. Biological basis of prophylaxis of nematodoses.	<ol style="list-style-type: none">5. Bulbus –6. Muscular tremor –7. Vesicule –8. Larva migrans –
<p style="text-align: center;">BASIC TERMS AND CONCEPTS</p> <ol style="list-style-type: none">1. Migration ascariasis–2. Geohelminthes –3. Dehelmithization4. Migration	<p style="text-align: center;">TESTS FOR SELF-CONTROL</p> <ol style="list-style-type: none">1. The features of trichinella's life cycle are: a) life cycle requires 2 different hosts: the principal and intermediate; b) one organism is at first principal and then intermediate host; c) development of larva occurs in soil or water; d) larvae are capable of penetrating host's skin.2. Diagnostic signs of trichinelliasis are: a) brain lesion; b) gastrointestinal disorders; c) rising of temperature and eosinophilla; d) oedema of eyelids and face, pains in muscles; e) enlargement of liver and spleen.3. Diagnostic signs of migration ascariasis are: a) intestinal obstruction; b) fever and an asthmatic bronchitis; c) non-constant eosinophilic infiltrations in lungs; d) occlusion of choledoch duct; e) appendicitis.4. Surgical implications of ascariasis are: a) obstructive jaundice and obstruction of the intestine; b) affection of an eyeball by an adult worm; c) perforation of the intestinal wall; d) pneumonia and bronchitis; e) pancreatitis and appendicitis.5. Morphophysiological features of whipworm are: a) length of a female is 5 cm, has a vesicula on the anterior end of a body; b) length of a female is 3–5 cm female length, has a bulb and an buccal capsule with teeth; c) length of a female is 3–5 cm, anterior end of the body is thread-like whive posterior end of the body is thicker; d) has cuticular lips, feeds on the intestinal contents; e) feeds on blood.

Fill in the table:

Feature \ Parasites	<i>T. spiralis</i>	<i>E.vermicularis</i>
1. Disease		
2. Peculiarities of morphology		
3. Invasive stage for human		
4. Rotes of transmission		
5. Migration way of larvae		
6. Location in the human body		
7. Pathogenic action		
8. Symptoms		
9. Morphology of eggs		
10. Possible complications		
11. Laboratory diagnostics		
12. Prophylaxis		

Fill in the table:

Feature \ Parasites	<i>A. lumbricoides</i>	<i>T. trichiurus</i>
1. Disease		
2. Peculiarities of morphology		
3. Invasive stage for human		
4. Routes of transmission		
5. Migration way of larvae		
6. Location in the human body		
7. Pathogenic action		
8. Symptoms		
9. Morphology of eggs		
10. Possible complications		
11. Laboratory diagnostics		
12. Prophylaxis		

Fill in the gaps:

1. Symplast tissue of nematode's dermo-muscular body wall is called...
2. Contact helminth among roundworms is ...
3. Life span of *Enterobius vermicularis* in human organism is about...
4. Body wall of roundworm has ... layer(s) of smooth muscle.
5. Life span of mature *Ascaris* in the human body is about...
6. Pig and dog ascaris larva migrating in the human body cause syndrome ...
7. Nematode which has thin thread-like anterior end of the body is called ...

PRACTICAL WORK

Task I. Study and draw the preparations, make the indications.

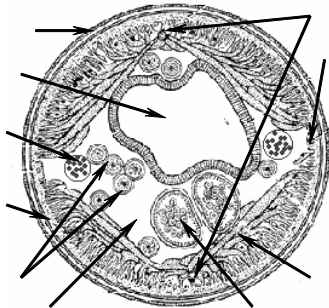


Fig.1. Cross-section of *Ascaris* (7×8)

1 – cuticle, 2 – hypodermis, 3 – muscle cells, 4 – pseudocoelom, 5 – canal of excretory system, 6 – nerve cords, 7 – lumen of the intestine, 8 – ovaries, 9 – oviducts, 10 – uteri.

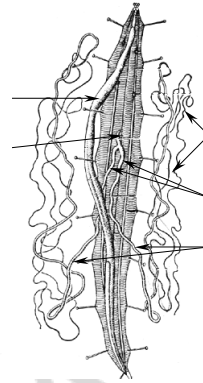


Fig.2. Dissected female *Ascaris*
()

(macropreparation)

1 – ovaries, 2 – oviducts, 3 – uteri,
4 – vagina, 5 – intestine.

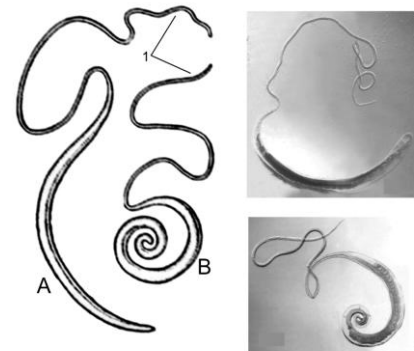


Fig.3. *Trichocephalus trichiurus*.

A, B, – schemes, C, D – microphotos, A, C – female, B, D – male.

D 1 –



Fig.4. Egg of an *Ascaris* (7×40)

()

1 – torus protein membrane.

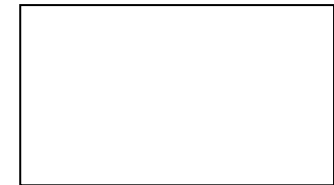


Fig.5. Egg of a whipworm

(7×40)

1 – membrane, 2 – lids.

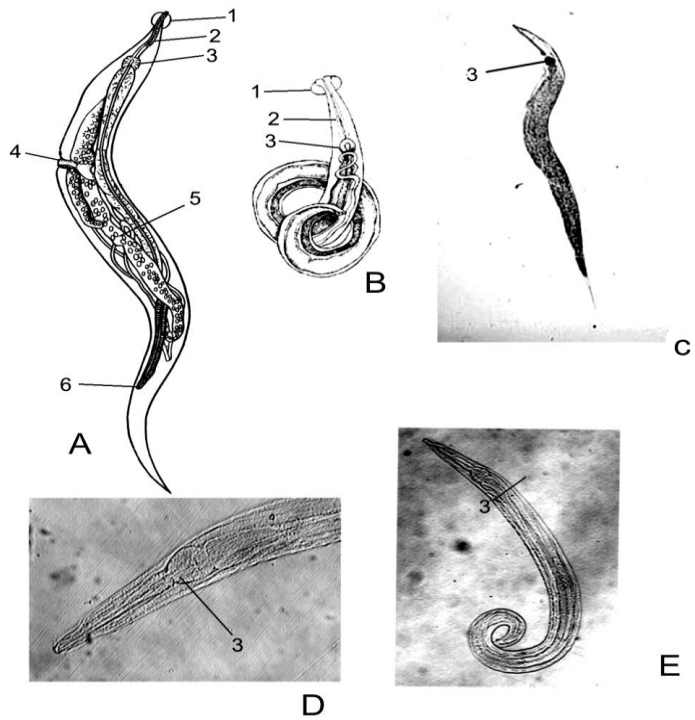


Fig.6. Enterobius vermicularis. A, B – schemes, C, D, E – microphotos, A, C, D – female, B, E – male.

- | | |
|-----|-----|
| 1 – | 2 – |
| 3 – | 4 – |
| 5 – | 6 – |

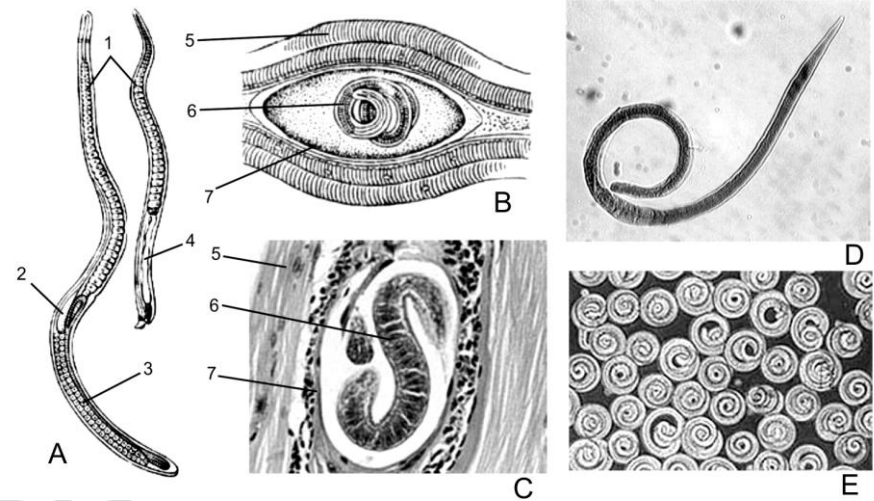


Fig.7. Trichinella spiralis. A – sexually mature worms (scheme), B – larva, covered with capsule (scheme), C – incapsulated larva (7×40), D – male (7×40), E – larvae without capsule (7×8)

- 1 –
- 2 –
- 3 –
- 4 –
- 5 –
- 6 –
- 7 –

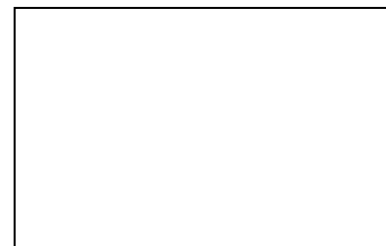


Fig.8. Egg of seatworm (7x40)
()

Teacher's signature

Practice 6 (25). Topic: **PHYLUM ARTHROPODA. CLASS ARACHNIDA. TOXIC ANIMALS.** " ____ " _____ 201__ year

Purpose of the practice: to study the features of phylum Arthropoda, class Arachnida; to know the peculiarities of morphology and biology of the order Ticks and their medical significance; to study the classification and species of venomous animals, structure of apparatus for injecting venom and physiological characteristic of toxins, their action on the human; the first aid and prophylactic measures against bites and poisoning.

<p style="text-align: center;">CONTROL QUESTIONS</p> <ol style="list-style-type: none"> 1. General characteristic and taxonomy of the phylum Arthropoda. 2. General characteristic and taxonomy of the class Arachnida. 3. Order Acarina, families Ixodidae, Argasidae, Gamasidae. 4. Classification of venomous animals (primarily-secondarily venomous, actively and passively venomous). 5. Physiological characteristic of toxins of invertebrates (jellyfish, arachnoids, hymenoptera), their effect on the body; the first aid and prophylaxis of bites and poisoning. 6. Physiological characteristic of toxins of vertebrate animals (fishes, amphibians, reptiles), their effect on the body; the first aid and prophylaxis of bites and poisoning. 	<ol style="list-style-type: none"> 4. Passively-poisonous animals – 5. Primarily-toxic animals – 6. Pedipalps and chelicerae – 7. Specific vector – 8. Transovarial transmission –
<p style="text-align: center;">BASIC TERMS AND CONCEPTS</p> <ol style="list-style-type: none"> 1. Actively-venomous animals – 2. Mechanic vector – 3. Secondarily-toxic animals – 	<p style="text-align: center;">TESTS FOR SELF-CONTROL</p> <ol style="list-style-type: none"> 1. Vector-borne diseases are transmitted by: a) contact between a healthy and a sick person; b) drinking water from the open resources; c) eating contaminated meat and a fish; d) blood-sucking arthropods; e) alimentary route. 2. A natural focus of a vector-borne disease requires: a) pathogen and vector; b) resistant organisms; c) organisms sensitive to the pathogen; d) human; e) certain conditions of medium.

3. **The main components of vector-borne disease:** a) the pathogen and vector of the disease; b) organism resisting to the pathogen; c) pathogen, host and vector; d) human population; e) arthropods population.
4. **Specific vector of disease is an organism:** a) where the pathogen undergoes definite development stages, obligatory for the parasite; b) where the pathogen doesn't undergo definite development stages, obligatory for the parasite; c) carrying pathogens on body surface or on mouthparts; d) where the pathogen doesn't undergo definite development stages, facultative for the parasite; e) where the pathogen passes through the intestinal tract without reproduction.
5. **Features of Ixodidae family are:** a) habitation is forests and steppe; b) habitation is caves, holes of rodents, abandoned buildings; c) blood meal lasts up to several days; d) can starve up to 12–15 years; e) females lay 50–200 eggs.
6. **Dermanissus gallinae belongs to the family:** a) Ixodidae; b) Argasidae; c) Gamasidae; d) Tyroglyphidae; e) Sarcoptidae.
7. **Morphology of Tyroglyphidae ticks:** a) slightly-yellow color of body, sizes are 0.4–0.7 cm; b) slightly-brown colour of body, eyes are absent; c) slightly-yellow colour, sizes are 0.4–0.7 μm, has eyes; d) slightly-black colour, eyes are absent; e) slightly-yellow color, sizes are 0.4–0.7 mm, without eyes.
8. **The flour mite parasitizes in:** a) genitourinary and respiratory systems; b) liver and pancreas; c) blood and lymph; d) gastrointestinal system; e) respiratory system and skin.
9. **Medical significance of Tyroglyphus farinae:** a) it is a specific vector of tularemia and anthrax; b) it is a specific vector of tick-borne relapsing fever; c) it causes scabies and bronchospasms; d) it causes a grain itch and asthmatic symptoms; e) it causes meningoencephalitis.
10. **Medical significance of Sarcoptes scabiei:** a) it is a specific vector of tick-borne relapsing fever; b) it is a specific vector of tularemia and brucellosis; c) it causes inflammation of the intestine; d) it causes asthmatic symptoms; e) it causes scabies.
11. **Scabies is spread:** a) by vector-bone route; b) during a direct skin contact with a sick person; c) by eating of uncooked fish; d) by bedclothes of sick persons; e) by drinking water from the open sources.
12. **Prophylaxis of scabies is:** a) revealing and treating sick persons; b) elimination of vectors; c) maintaining the purity of the body; d) washing vegetables and fruits before eating; e) sanitary inspection of hostels, bathhouses and health education.
13. **Actively-venomous and poisonous animals:** a) jellyfish and snails; b) cobra and tarantula; c) python and tarantula; d) tarantula and pufferfish; e) pufferfish and snails.
14. **Passively-poisonous animals:** a) jellyfishes and a tarantula; b) cobra and a boa; c) python and a pufferfish; d) tarantula and snails; e) pufferfish and snails.
15. **Actively-venomous animals:** a) snakes and sting ray; b) pufferfish and wasps; c) bees and amphibians; d) snails and bees; e) snakes and amphibians.
16. **Actively-poisonous animals:** a) both snakes and amphibians; b) pufferfish and sting ray; c) bees and sting ray; d) snails and amphibians; e) sting ray and snails.
17. **Toads and frogs are:** a) primary-toxic; b) secondary-toxic; c) actively-poisonous; d) passively-poisonous; e) secondary-venomous.
18. **Bees and wasps are:** a) primary-toxic; b) secondary-toxic; c) actively-venomous; d) passively-venomous; e) passively-poisonous.
19. **Factors determining clinical presentation of toxication with zootoxins are:** a) composition and the volume of the venom; b) site of biting; c) sex of the affected person; d) habitus of the affected person; e) time of a day.

Fill in the gaps:

- 20. Symptoms of toxication with scorpion venom:** a) a sharp pain, hyperemia and edema of the affected area; b) hyperemia and edema of the injured area, fear; c) neither hyperemia nor edema of the injured place, but nausea and vomiting; d) sharp pain, fear; e) fear, nausea and vomiting.
- 21. Symptoms of toxication with tarantula venom:** a) sharp pain and drowsiness; b) hyperemia and a edema of the affected area, necrosis of skin; c) neither hyperemia nor edema of the affected area; d) hyperemia and edema of the affected area, drowsiness; e) drowsiness, necrosis of skin.
- 22. Symptoms of toxication with bee or wasps venom:** a) sharp pain, fear; b) hyperemia and edema of the affected area, allergic reactions; c) neither hyperemia nor edema of the injured area; d) allergic reactions, of fear; e) sharp pain.
- 23. Symptoms of toxication with cobra venom:** a) sharp pain, inflammation of lymphatic vessels; b) inflammation of lymphatic vessels, a necrosis of tissues; c) sharp pain, necrosis of tissues; d) excitation and then depression of CNS, necrosis of tissues; e) excitation and then depression of CNS, impairment of respiration are observed.
- 24. Symptoms of toxication with Viper snakes venom:** a) sharp pain and impairment of blood clotting; b) extremities numbness and hemorrhagic edema; c) hemorrhagic edema; d) numbness of extremities and impairment of respiration; e) impairment of blood clotting and respiration.
- 25. First aid in a toxication with hymenopterian venom:** a) to suck off the venom, to treat the area of stinging with disinfectants; b) to remove a sting, to treat the place of stinging with disinfectants; c) to treat the place of stinging with disinfectants, to apply heat to a place of stinging; d) to apply a warm compressive bandage to the place of stinging; e) to leave a sting, to treat the place of stinging with disinfectants.
- 26. First aid in a toxication with snake venom is:** a) to suck away venom and to treat the place of a biting with disinfectants; b) to scorch the place of biting and to put a victim in a shade; c) to scorch and to treat the place of a biting with disinfectants; d) to transport a victim in lying position; e) to apply a hard bandage to a place of a biting and to transport a victim in any position.

1. Excretory organs of arachnids are ... glands and Malpighian tubules.
2. Ixodidae family includes genuses Ixodes, Hyalomma and ...
3. Transmission of a pathogen from imago to larva through the ovum is called...
4. *Ixodes ricinus* is a specific vector of ...
5. *Hyalomma anatolicum* is a specific vector of ...
6. Absence of scutum and eyes, and presence of marginal welt are typical for ticks of family...
7. Grain itch is caused by ...
8. Toxic animals having specialized venomous glands and apparatus for biting are called ...
9. According to physiological effect on the body zootoxins are divided into neurotoxins, cytotoxins, hemorrhagins and ...
10. Physalia's stinging organs are ...
11. Toxin of a scorpion belongs to ...
12. Toxin of a karakurt belongs to ...
13. Toxins of a Brazilian spider belong to cytotoxins and ...
14. Toxins of hymenopterans belong to cytotoxins and ...
15. Toxin of Colombian cocoa frog is ... times stronger than tetanus toxin.

Fill in the tables: table 1

Morphological and biological peculiarities	Family Ixodidae	Family Argasidae
1. Habitat		
2. Body sizes		
3. Body shape		
4. Presence of scutum		
5. Position of mouthparts		
6. Duration of blood meal		
7. Possible duration of starving		
8. The number of eggs laid by one female		
9. The number of nymph stages		

Table 2

Family, genera	Diseases	Transmitted diseases
Family Ixodidae		
g. Ixodes		
g. Dermacentor		
g. Hyalomma		
Family Argasidae		
g. Ornithodoros		
g. Argas		
Family Gamasidae, g. Dermanyssus		
Family Tyroglyphidae g. Tyroglyphus		
Family Sarcoptidae g. Sarcoptes		

Fill in the table

Species	Characteristic of animal venoms. Apparatus for injecting venom	Physiological characteristic of venom	Clinics of poisoning	The first aid and prophylaxis of poisoning.
Phylum Coelenterate: - Jellyfish				
Phylum Arthropoda: - Scorpions - Arachnoidea - Hymenopterans				
Phylum Chordata - Snakes a) Elapidae (cobra) b) Viperidae (blunt-nosed viper, carpet viper, common viper)				

PRACTICAL WORK

Study the preparations, color the pictures, and make the indications

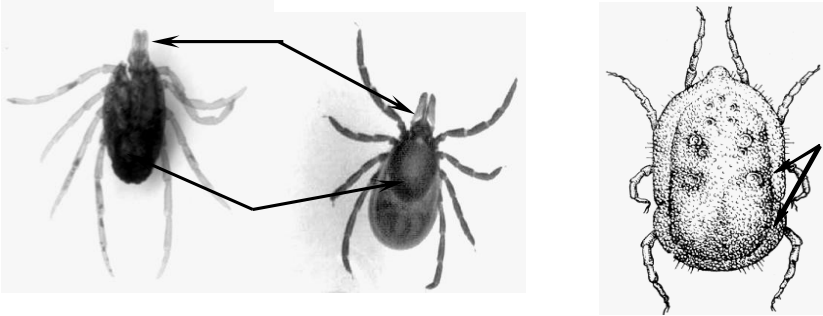


Fig.1. Castor bean tick (magnifying glass)
()
1 – scutum, 2 – capitulum

Fig.2. O. papillipes (magnifying glass)
()
1 – marginal welt



Fig. 3. Itch mite (7x40)
()

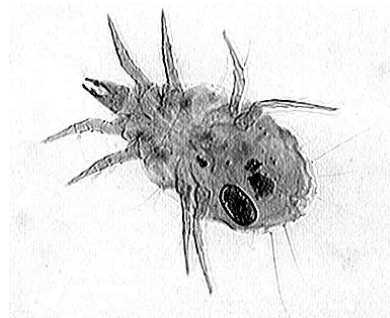


Fig. 4. Flour mite (7x40)
()

Study the preparation, colour the pictures, and sign the indications:

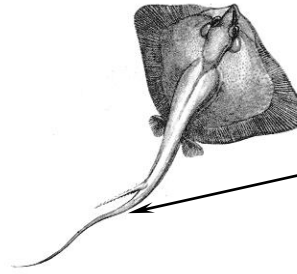


Fig. 5. Sting ray
1 – stinger.

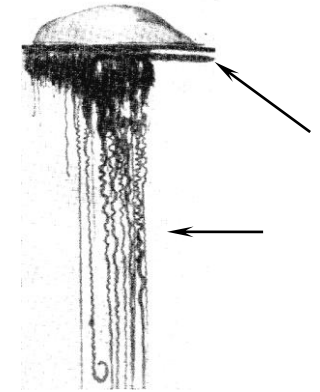


Fig. 6. Portuguese man-of-war
1 – bell, 2 – tentacles.



Fig. 7. Honey bee
1 – sting.

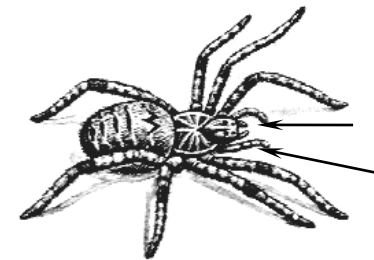


Fig. 8. Tarantulas
1 – chelicerae, 2 – pedipalps.

Teacher's signature

Practice 7 (26). Topic: PHULUM ARTHROPODA, CLASS INSECTA

"____" 201____ year

Purpose of the practice: to study morphological and biological peculiarities of insects; to study medical significance of lice, fleas, cockroaches, bugs, and measures of struggle with them.

CONTROL QUESTIONS

1. General characteristic and taxonomy of the class Insecta.
2. Order **Anoplura**: peculiarities of morphology and biology; lice as pathogens and vectors of diseases; prophylaxis
3. Order Aphaniptera: peculiarities of morphology and biology; medical significance; prophylaxis
4. Order Blattoidea: peculiarities of morphology and biology; medical significance; prophylaxis
5. Order Heteroptera: peculiarities of morphology and biology; medical significance; prophylaxis
6. Morphological and biological peculiarities of the order Diptera.
7. Components of gnat (**black flies, midges, sand flies, horse-flies, mosquitoes**), their morphological and biological peculiarities and medical significance.
8. Mosquitoes of genera Culex, Anopheles and Aedes: morphological and biological peculiarities and medical significance.
9. Flies (**house fly, stable fly, tsetse fly, spotted flesh fly**), morphological and biological peculiarities and medical significance.
10. Medical significance of horse bot-flies.

BASIC TERMS AND CONCEPTS

1. **Gnat** –
2. **Gonotrophic cycle** –

3. Inoculation –

4. Insecticides –

5. Contamination –

6. Pediculosis –

7. Phthiriasis –

8. Myiasis –

9. Repellents –

10. Zooprophyllaxis –

TESTS FOR SELF-CONTROL

- 1. Morphological features of cockroaches:** a) the body is flattened in a dorsal-ventral direction, its length reaches 3 cm; b) the body is flattened in a lateral direction, its length reaches 3 cm; c) the body is 3 cm in length, gnawing mouthparts; d) the body is 8 cm in length, chewing mouthparts; e) the body is flattened in a dorsal-ventral direction, piercing-sucking mouthparts.
- 2. Medical significance of cockroaches:** a) mechanic vectors of eggs of helminthes, protozoans cysts; b) specific vectors of tularemia and pathogens of tuberculosis; c) specific vectors of malaria and pathogens of filariasis; d) gnaw skin epidermis more often around lips and cause infections; e) cause inflammation of gastrointestinal tract.
- 3. Morphology of a bed bug:** a) the body is laterally flattened, can reach to 8 mm in length; b) the body is flattened in dorsal-ventral direction, can reach to 8 mm in length; c) the body is flattened in dorsal-ventral direction, can reach to 8 mm in length; d) dark-brown bug, has no odorous glands; e) dark-red bug, has no odorous glands.
- 4. Morphology of kiss bug:** a) the body can reach 10.5 cm; b) body size is up to 3.5 mm; c) the body is flattened in a dorsal-ventral direction can reach 3.5 cm, also it has well developed wings; d) the body is laterally flattened, it has well developed wings; e) the body is flattened in a dorsal-ventral direction, wings are absent.
- 5. Morphology of the head louse:** a) the body length is 1–4 mm, has no wings; b) the body length is 1–4 mm, one pair of wings; c) mouthparts are chewing; d) the body length is 2–4 mm, wings are absent; e) mouthparts are piercing-sucking.
- 6. Morphology of pubic louse:** a) sizes up to 1.5 mm; b) sizes up to 1.5 cm; c) the body is short, almost round; d) piercing-sucking mouthparts; e) the body is short, almost square.

- 7. Medical significance of a bed bug:** a) mechanic vectors of eggs of helminthes and cysts of protozoans; b) specific vectors of the plague and tuberculosis; c) bites are painful, may cause dermatitis; d) mechanic vectors of tularemia; e) larvae cause myiasis.
- 8. Morphology of fleas:** a) the body is flattened in a dorsal-ventral direction; b) the body is laterally flattened; c) piercing-sucking mouthparts, wings are absent; d) one pair of wings; e) chewing mouthparts.
- 9. Medical significance of fleas:** a) mechanic vectors of the tuberculosis and the dysentery; b) specific vectors of protozoans cysts and eggs of helminthes; c) specific vectors of the plague and the tularemia; d) bites are painful, may cause dermatitis; e) mechanic vectors of tularemia.
- 10. Life cycle features of order Anoplura are:** a) lay eggs in dry dust and on food products; b) nits stick to hair; c) development is direct; d) development with incomplete metamorphosis; e) duration of the life cycle is 48 days.
- 11. Medical significance of order Anoplura is:** a) mechanic vectors of helminthes' eggs and protozoans' cysts; b) specific vectors of the louse-borne relapsing fever; c) specific vectors of epidemic typhus; d) lice of genus Pediculus cause pediculosis; e) pubic lice cause phthiriasis.
- 12. Morphology of pubic louse:** a) sizes up to 1.5 mm; b) sizes up to 1.5 cm; c) the body is short, almost round; d) piercing-sucking mouthparts; e) the body is short, almost square.
- 13. Morphology of house fly:** a) the body is about 7.5 mm in length, licking mouthparts; b) the body is about 7.5 mm in length, piercing-licking mouthparts; c) sticky pads on the legs, one pair of wings; d) piercing-licking mouthparts, sticky pads on the legs; e) chewing mouthparts, two pairs of wings.
- 14. Morphology of house fly:** a) the body is about 7.5 mm in length, licking mouthparts; b) the body is about 7.5 mm in length, piercing-licking mouthparts; c) sticky pads on the legs, one pair of wings; d) piercing-licking mouthparts, sticky pads on the legs; e) chewing mouthparts, two pairs of wings

15. Morphology of pre-imago stages of Anopheles mosquitoes: a) eggs have no air chambers, larvae have a siphon; b) eggs have air chambers, larvae have siphon; c) larvae have no siphon, and **chrysalides** have a conical siphon; d) eggs have air chambers, **chrysalides** have a cylinder shape siphons; e) eggs have air chambers, **chrysalides** have a conic siphon.

16. Morphology of mature Anopheles mosquitoes: a) antennae of females are hairy, palps are equal in length to the proboscis; b) antennae of females are almost not hairy and palps are equal in length to the proboscis; c) antennae of males are hairy and palps are shorter than the proboscis; d) antennae of males are hairy and palps have club-like thickenings at ends; e) antennae of males are hairy and palps have no club-shaped thickenings.

17. Medical significance of Anopheles mosquitoes: a) mechanic vectors of cysts of **protozoans** and eggs of helminthes; b) **specific vectors** of tularemia and the plague originators; c) specific vectors and **principal** hosts of malaria **parasites**; d) **specific vectors** of onchocercosis; e) specific vectors and intermediate hosts of **wuchereria bancrofti**.

18. tularemia and the Japanese encephalitis; b) **specific** vectors of cysts of **protozoans** and eggs of helminthes; c) **specific vectors** of the plague and tuberculosis; d) specific vectors and **principal** hosts of malaria **parasites**; e) **specific vectors** of **brugia malayi**.

19. Medical significance of Culex mosquitoes: a) mechanic vectors of tularemia and Japanese encephalitis; b) **specific vectors** of **protozoans'** cysts and helminthes' eggs; c) **specific vectors** of malaria parasite; d) **specific vectors** of **wuchereria bancrofti** and **brugia malayi**; e) **specific vectors** of **brugia malayi**.

20. Medical significance of a stable flies: a) mechanic vectors of cysts of **protozoans** and eggs of helminthes; b) mechanic vectors of anthrax; c) **specific vectors** anthrax; d) larvae may cause myiasis; e) bites are painful.

Fill in the gaps:

1. Fleas have important epidemiological significance because they are specific **vectors** of...
2. **House fly** is a ... **vector of** infectious and invasive diseases.
3. Stomoxys calcitrans is a mechanic **vector** of...
4. Glossina palpalis is a specific **vector** of ...
5. Midges are **specific vectors of**... .
6. **Midges belong to the family**... .
7. Mosquitoes of the genus ... lay eggs in clear water reservoirs.
8. Natural reservoir of the plague **are**...
9. Sarcophylla penetrans causes
10. Pediculus humanus capitis and Pediculus humanus humanus cause ..
11. Phthirus pubis causes ...
12. Eggs of lice are called ...
13. **Insects of the order ... are specific vectors of epidemic typhus.**
14. **Pathogen of louse-borne relapsing fever is ...**

Fill in the tables: table 1

Parasites	<i>P. humanus capitis</i>	<i>P. humanus humanus</i>	<i>Ph. pubis</i>	<i>P. irritans</i>
Features				
1. Morphology				
2. Type of development				
3. Caused disease				
4. Transmitted diseases				
5. Location of parasite				
6. Rote of transmission				
7. Prevention				

Fill in the tables: table 2

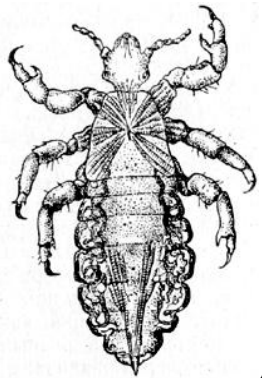
Genera	Peculiarities of morphology	Eggs	Larvae	Pupae	Head	
					Females	males
	Anopheles					
	Culex					

Table 3

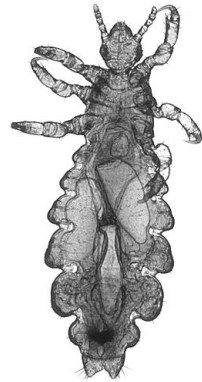
Gnats genera	Name of the illness	Malaria	Japanese encephalitis	Yellow fever	Dengue fever	Lymphocytic choriomeningitis	Anthrax	Tularemia
		Anopheles						
Culex								
Aedes								

PRACTICAL WORK

I. Study the preparations, color the pictures, and make the indications



A



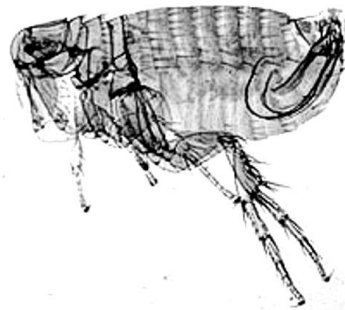
B

Fig.1. Head's louse

A – scheme, B – microphoto (magnifying glass)
()



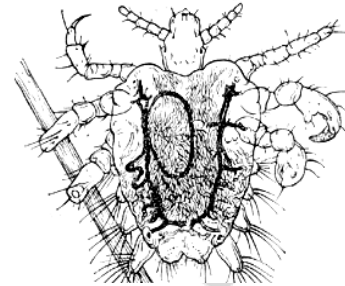
A



B

Fig.2. Human flea

A- scheme of the structure, B – micro photos (7x8)
()



A



B

Fig.3. Pubic louse. A – scheme, B – microphoto (7x8)

()

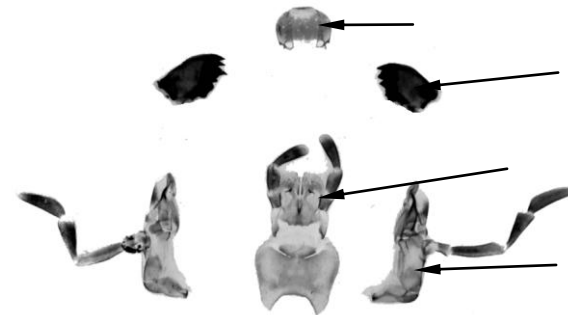


Fig.4. Mouthparts of a cockroach (magnifying glass)

()
1 – upper lip, 2 – upper mandible, 3 – lower lip, 4 – lower mandible

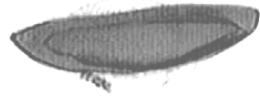


Fig.5. Eggs of mosquitoes: g. Culex (A); g. Anopheles (B) (7×8)

() ()
1 – air chambers

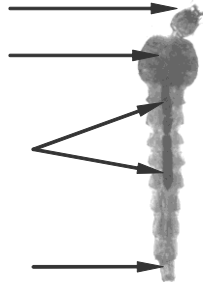
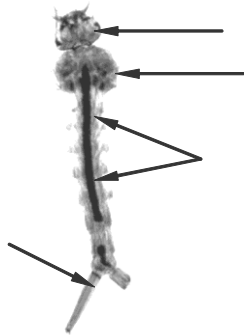


Fig.6. Larvae of mosquitoes: Culex (A) and Anopheles (B) (7×8):

1 – head, 2 – thorax, 3 – abdomen, 4 – spiracles, 5 – respiratory siphons.

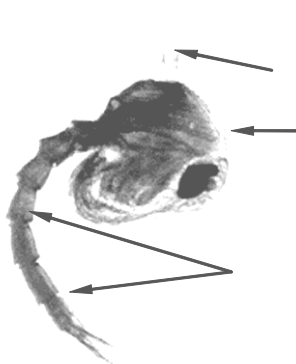


Fig. 7. Pupae of mosquitoes: Culex (A) and Anopheles (B) (7×8):

1 – cephalothorax, 2 – abdomen, 3 – cylinder-shaped respiratory siphons,
4 – cone-shaped respiratory siphons.

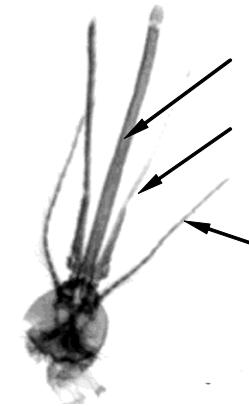


Fig.8. Heads of female mosquitoes: Culex (A) and Anopheles (B) (7×8):

1 – proboscis, 2 – palps, 3 – antennae.

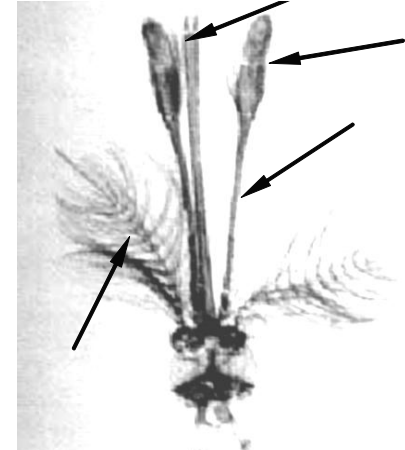
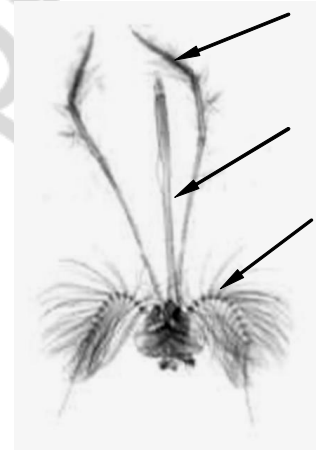


Fig.9. Heads of male mosquitoes: Culex (A) and Anopheles (B) (7×8):

1 – proboscis, 2 – palps, 3 – antennae, 4 – thickenings of palps.

Teacher's signature

Practice 8. Topic: **INHERITANCE REGULARITIES. INTERACTION OF GENES.** "___" _____ 201___ year

Purpose of the practice: to study the inheritance laws during the mono- and polyhybrid crossing, intra- and interallelic gene interaction; to learn how to solve standard problems that demonstrate the objective laws of mono- and polyhybrid crossing, gene interaction.

<p style="text-align: center;">CONTROL QUESTIONS</p> <ol style="list-style-type: none">1. Genetics as a science. Basic concepts of Genetics.2. Peculiarities of the hybridological method.3. Inheritance regularities in monohybrid crossing.4. Analyzing cross. Phenotypic radical.5. Regularities of inheritance in polyhybrid crossing. The Law of Independent Assortment.6. Conditions limiting the Mendel's laws. Pleiotropy. Semi-lethal and lethal genes.7. Intra-allelic interaction of genes. Inheritance of blood groups.8. Inter-allelic interaction of genes.	<ol style="list-style-type: none">4. Genotype –5. Homozygous organism –6. Multiple allelism –7. Phenotypic radical –
<p style="text-align: center;">BASIC TERMS AND CONCEPTS</p> <ol style="list-style-type: none">1. Allelic genes –2. Complementation –3. Genome –	<ol style="list-style-type: none">8. Phenotype –9. Polygenic inheritance –10. Superdominance –

TESTS FOR SELF-CONTROL

- The main features of G. Mendel's hybridological method are:** a) one or of two pairs of alternative alleles are analyzed; b) many alternative alleles are analyzed; c) analysis starts with cross of homozygous organisms; d) several generations are analyzed; e) one generation is analyzed.
- Concepts of the hypothesis of purity of gametes:** a) genes of one allelic pair of a hybrid organism are hybridized; b) genes of one allelic pair of a hybrid organism are not hybridized; c) genes of different allelic pairs can be hybridized; d) both allelic genes get in one gamete; e) from each pair of allelic genes one gene gets into gamete.
- The conditions necessary for actuality of Mendel's laws:** a) codominance; b) semidominance; c) presence of lethal genes; d) equiprobable formation of gametes and zygotes of different types; e) genes of different allelic pairs are in one chromosome.
- Analyzing cross is performed to reveal:** a) mutations; b) a phenotype of the individual; c) a genotype of the individual with a recessive character; d) a genotype of the individual with dominant character; e) lethal genes.
- Features of incomplete dominance are:** a) a dominant gene does not completely suppress the action of a recessive gene; b) the dominant gene completely suppress the action of a recessive one; c) homo- and heterozygotes are identical phenotypically; d) homo- and heterozygotes are not identical phenotypically; e) the dominant gene in a heterozygous state express stronger, than in homozygous.
- Features of co-dominance are:** a) the dominant gene does not completely suppress the action of recessive gene; b) it is a type of interaction of allelic genes, genes are equivalent; c) homo- and heterozygotes are identical phenotypically; d) it is a type of interaction of non-allelic genes; e) the dominant gene in a heterozygous state express stronger, than in homozygous.
- Features of polymericity are:** a) mutual influence of different alleles that occupy adjacent loci of one chromosome; b) 2 dominant genes of different allelic pairs are responsible for a new character; c) 2 recessive genes of different allelic pairs are responsible for a new character; d) one gene is responsible for different characters; e) genes from different allelic pairs have an effect on a manifestation degree of one character.

Fill in the gaps:

- Characters with different qualitative states are called ...
- The second and third Mendel's laws require the gene penetrance ... %.
- Bombay phenomenon is an example of the genetic interaction which is called ...
- Phenotypic segregation in ratio 9:7 in crossing diheterozygotes result from interallelic gene interaction called
- Independent combination of two pairs of allelic genes during an analyzing cross result in phenotypic segregation ... in the first generation of offsprings.
- Alleles presented in the populations more than in two states are called ...

PRACTICAL WORK

Solve the problems:

Problem No.1. How many and what type of gametes would be formed in the organisms with the genotypes:

P: AaBbDd

AAbbCCddRR?

Problem No.2. Brown color of eyes is dominant human character while blue color is recessive. The parents of a blue-eyed child have got brown eyes. Find the genotypes of all members of the family.

Character	Gene	Genotype
Brown eyes	B	BB; Bb
Blue eyes	b	bb

Problem No.3. The allele of brown eyes color dominate over the allele of blue color and the allele of right-handedness (a habit to use mostly the right hand to perform usual work) dominate over the allele of left-handedness. The genes of both characters are situated in the different chromosomes. Parents are brown-eyed right-handed diheterozygotes. What characters would their children get and what is their percentage ratio?

Problem No. 4. A woman has blood group I (0), Rh-, MN, her husband has blood group IV (AB), Rh+ (homozygote), N. Which combinations of blood groups by all systems will their children get?

Human's blood group inheritance

Signs	Gene	Genotype	Signs	Gene	Genotype
ABO system			MN system		
Group I (0)	I^O	$I^O I^O$	Group M	L^M	$L^M L^M$
Group II (A)	I^A	$I^A I^A, I^A I^O$	Group N	L^N	$L^N L^N$
Group III (B)	I^B	$I^B I^B, I^B I^O$	Group MN	L^M and L^N	$L^M L^N$
Group IV (AB)	I^A and I^B	$I^A I^B$			
Rh system					
Rh+	D	DD, Dd			
Rh-	d	dd			

Problem No.5. Congenital deafness can be determined by recessive genes **d** and **e**. The presence of both dominant alleles (**D** and **E**) is necessary for normal hearing. Find out the genotypes of parents if both of them are deaf and their seven children have normal hearing.

Teacher's signature

Practice 9. Topic: GENETIC LINKAGE " ____ " _____ 201 ____ year

Purpose of the practice: to get acquainted with T. Morgan experiments in the linked inheritance, to study the inheritance in cases of autosomal and gonosomal linkage, to know how to write gametes and solve the problems in gene linkage, to compose and analyze chromosome maps.

CONTROL QUESTIONS	TESTS FOR SELF-CONTROL
<p>CONTROL QUESTIONS</p> <ol style="list-style-type: none">1. Experiments of T. Morgan. Complete and incomplete genetic linkage.2. Autosomal and gonosomal linkage groups.3. Crossing-over, crossover and non-crossover gametes.4. Basic concepts of the chromosome theory of inheritance.5. Maps of eukariotic chromosomes (genetic and cytological). <hr/> <p>BASIC TERMS AND CONCEPTS</p> <ol style="list-style-type: none">1. Cytological map of a chromosome –2. Crossover gametes –3. Genetic map of the chromosome –4. Linkage of genes –5. Non-crossover gametes –6. Recombinants –	<ol style="list-style-type: none">1. The phenomenon of genetic linkage is observed when genes of different allelic pairs are situated: a) in the same chromosome; b) in the different chromosomes; c) only in the autosomes; d) only in the X-chromosome; e) only in the Y-chromosome.2. Complete genetic linkage is observed: a) in a female <i>Drosophila</i> and a male silkworm; b) if non-allelic genes are located in different chromosomes; c) if crossing-over occurs; d) if crossing-over does not occur; e) in a male <i>Drosophila</i> and a female silkworm.3. Incomplete genetic linkage is observed: a) if genes of different allele pairs are located in one chromosome; b) if non-allelic genes are located in different chromosomes; c) if crossing-over occurs; d) if crossing-over does not occur; e) in a male <i>Drosophila</i> and a female silkworm.4. The main concepts of the chromosome theory of inheritance are: a) allelic genes are located in the linear order in identical locus's of homologous chromosomes; b) allelic genes occupy different locus's of homologous chromosomes; c) the number of linkage groups is equal to monoploid set of chromosomes; d) the number of linkage groups is equal to diploid set of chromosomes; e) between homologous chromosomes of <i>Drosophila</i> male the crossing-over is possible.5. Phenotypic segregation ratio for monohybrid cross of homozygotes at complete dominance: a) is absent; b) 3:1; c) 1:2:1; d) 9:3:3:1; e) 1:1.6. Phenotypic segregation ratio for incomplete genetic linkage in Morgan's experiences: a) 3:1; b) 1:2:1; c) 9:3:3:1; d) 1:1; e) 41.5:8.5:8.5:41.5.7. Phenotypic segregation ratio for complete linkage in Morgan's experiences: a) 41.5:8.5:8.5:41.5; b) 3:1; c) 1:2:1; d) 9:3:3:1; e) 1:1.

Fill in the gaps:

1. Conditions limiting Mendel's 3rd law are: incomplete penetrance of genes, lethal and semi-lethal genes, unequal formation of different types of gametes and zygotes, genes' pleiotropy, interaction of genes apart from complete dominance and ...
2. If a diheterozygous organism forms only 2 types of gametes, then genetic linkage is ...
3. If a diheterozygous organism forms 4 types of gametes, then genetic linkage is...
4. If crossing-over occur between the genes of a pair of homologous chromosomes, then genetic linkage is....
5. Biological phenomenon breaking the genetic linkage is ...
6. The distance between genes measured in morganids is equal to % of ...
7. The maximal probability of crossing-over for linked genes is ... %.
8. Individuals formed from crossover gametes are called ...
9. The number of human's autosomal linkage groups is ...

Genetic experiment of T. Morgan:

Gene	Character
B	Grey colour of body
b	Black colour of body
V	Long wings
v	Short (vestigial) wings

Experiment 1.

P. BBVV x bbvv
 G. (BV) (bv)
 F₁. BbVv
 Grey colour of body with Long wings - 100 %

Experiment 2.

P. bbvv x BbVv
 G. (bv) (BV) (bv)
 F₁. bbvv 50% BbVv 50%

Experiment 3

P. BbVv x bbvv
 G. (BV) (bV) (bv)
 F₁. BbVv; Bbv; bbVv; bbvv
 41,5% 8,5% 8,5% 41,5%

PRACTICAL WORK

Solve the problems

Problem No.1. How many and which types of gametes are formed in the organisms of Drosophilae with the genotypes:

1. Male $\begin{matrix} A & B \\ \underline{\quad} & \underline{\quad} \\ a & b \end{matrix}$
2. Female $\begin{matrix} A & B \\ \underline{\quad} & \underline{\quad} \\ a & b \end{matrix}$
3. Male $\begin{matrix} AB \\ \underline{\quad} \\ ab \end{matrix}$
4. Female $\begin{matrix} AB \\ \underline{\quad} \\ ab \end{matrix}$

Problem No.2. The human's dominant gene of elliptocytosis (**El**) and the gene that code for the Rh-antigen on the erythrocytes (**D**) are situated in the same autosome at the distance 3 **centimorgans**. One of the spouses is heterozygous for both characters (Rh+ was inherited from the one parent and the elliptocytosis from the other one). The other spouse has the Rh- and normal erythrocytes. Find out the percentage of the possible genotypes and phenotypes of the children in this family.

Character	Gene	Genotype	Gene location
Rh+	D	D-	One autosome Distance D-El = 3 centomorgans
Rh-	d	dd	
Elliptocytosis	El	El-	
Norm	el	eel	

Teacher's signature

Practice 10. Topic: **VARIATION** "___" _____201___ year

Purpose of the practice: to study the main forms of variation, its reasons, medical and biological importance, mechanisms of gene, chromosome and genomic mutations, genetic material repair and biological principles of oncogenesis.

<p style="text-align: center;">CONTROL QUESTIONS</p> <ol style="list-style-type: none">1. Variation and its types.2. Phenotypic variation. The reaction norm.3. Genotypic variation and its types. Mutagenic factors.4. Classification of mutations.5. Genome, chromosome and gene mutations.6. Stability and repair of genetic material; anti-mutagens.7. Biological basis of cancerogenesis.	<ol style="list-style-type: none">5. Inversion –6. Reaction norm –7. Ring chromosomes –
<p style="text-align: center;">BASIC TERMS AND CONCEPTS</p> <ol style="list-style-type: none">1. Reading frame shift –2. Cancerogenesis –3. Deletions –4. Duplications –	<ol style="list-style-type: none">8. Transgenations –9. Transitions –10. Translocations –

TESTS FOR SELF-CONTROL







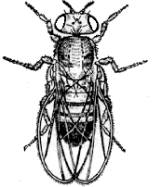
- 1. The properties of modifications:** a) have adaptive character; b) are inherited; c) are not inherited; d) are the **matter** for natural selection; e) are the **matter** for artificial selection.
- 2. Biological mutagens cause:** a) structural **defects** of genes and chromosomes; b) polyploidy; c) formation of thymine dimers; d) **haploidy**; e) embedding of its DNA in DNA of the host cells.
- 3. Characteristic features of gametic mutations are:** a) occur in sex cells; b) occur in somatic cells; c) **manifest** in the individual; d) pass to offsprings by sexual reproduction; e) pass to offsprings by asexual reproduction.
- 4. Types of functional genes mutations:** a) a transposition; b) impairment of the alternation of recognition and terminations; c) impairment of the alternation of initiation and elongation; d) impairment of the alternation of induction and repression; e) transitions.
- 5. Polyploidy is:** a) not multiple of a **haploid** complement increase of the chromosome number; b) multiple of a **haploid** complement increase of the chromosome number; c) not multiple of a **haploid** complement decrease of the chromosome number; d) multiple of a **haploid** complement decrease of the chromosome number; e) **haploid** set of chromosomes.
- 6. Haploidy is:** a) a positive mutation; b) nullsomy; c) monosomy; d) absence of one chromosome; e) a **haploid** set of chromosomes.
- 7. Kinds of structural genes mutations:** a) transductions; b) a transpositions; c) translocations; d) **reading frame shift**; e) transitions.
- 8. Stages' order of excision repair of a DNA:** 1) synthesis of a new DNA strand fragment; 2) ligation of the synthesized strand with the main strand; 3) recognition the damaged DNA strand; 4) cutting out of the damaged DNA fragment; 5) replication of a DNA molecule: a) 1-5-2-3; b) 5-1-3-2; c) 3-4-5-2; d) 3-4-2-1; e) 3-4-1-2.
- 9. According to the oncogene concept, the basis of carcinogenesis is:** a) protooncogenes received from parents or introduced **into the cell genome** by viruses; b) chromosome mutations of somatic cells; c) presence of protooncogenes in somatic cells of an organism; d) genome mutations of somatic cells; e) incorporations of viral DNA in the genome of somatic cells.

Fill in the gaps:

1. Enzymes capable of cutting out the damaged part of the DNA during the repair are ...
2. Transgenation when one purine base is replaced with another purine base is called ...
3. ... of the terminal parts of chromosomes leads to formation of ring chromosomes.
4. Mutation of ... genes leads to the impairment of alternation of repression and induction of genes.
5. Non-disjunction of chromosomes during the mitosis or meiosis leads to ... mutations.
6. Aneuploidy when only one chromosome of a pair is present in the karyotype is called ...
7. Genome mutation when somatic cells have single chromosome set is called ...
8. Disease caused by the infringement of DNA repair mechanisms and is characterized by insufficiency of red bone marrow functions resulting in deficit of blood cells and hyperpigmentation is called ...

PRACTICAL WORK

Task I. Study the preparations of drosophila flies mutations and add the missing elements

<p align="center">Eyes Bar</p> <p>Narrow, I chromosome, dominant character, chromosome mutation</p> 	<p align="center">Wings Curly</p> <p>Bend, II chromosome, dominant character, gene mutation</p> 	<p align="center">Body color Yellow</p> <p>Yellow, I chromosome, recessive character, gene mutation</p> 
<p align="center">White</p> <p>White, I chromosome, recessive character, gene mutation</p> 	<p align="center">Vestigial</p> <p>Vestigial, II chromosome, recessive character, gene mutation</p> 	<p align="center">Black</p> <p>Black, II chromosome, recessive character, gene mutation</p> 
<p align="center">Normal</p> <p>Red eyes, normal wings, grey body color</p> 		

Teacher's signature

Practice 11. Topic: **BIOLOGY AND GENETICS OF SEX** " ____ " _____201____ year

Purpose of the practice: to study the objective laws of sex inheritance, principles of its differentiation and determination, mechanisms of chromosomal sex diseases, to know how to solve problems in the context of the characters linked to the X-chromosome and holandric ones

<p style="text-align: center;">CONTROL QUESTIONS</p> <ol style="list-style-type: none">1. Sex as a biological character. Sex characters.2. Sex-controlled and sex-limited characters.3. X-linked and holandric characters.4. Chromosome theory of sex determination.5. Peculiarities of sex determination in humans and its impairments.6. Disorders associated with sex chromosomes.7. Primary, secondary and tertiary ratios of sexes.	<ol style="list-style-type: none">5. Holandric characters –6. Klinefelter syndrome –7. Morris syndrome –
<p style="text-align: center;">BASIC TERMS AND CONCEPTS</p> <ol style="list-style-type: none">1. Sex-controlled characters –2. Sex-limited characters –3. X-linked characters –4. Hermafroditism –	<ol style="list-style-type: none">8. Physical sex determinants –9. Shereshevsky-Turner syndrome –10. Transsexualism –11. Trisomy X syndrome –

TESTS FOR SELF-CONTROL

1. Formation of gonad **primordium proceeds until** the week of embryogenesis: a) 1st; b) 2nd; c) 3rd; d) 4th; e) 5th.
2. The differentiation of gonads' **primordia into the gonads occurs during** the weeks of embryogenesis: a) from 1st to 4th; b) from 4th to 6th; c) from 4th to 8th; d) from 4th to 12th; e) from 10th to 15th.
3. Till 4th week of an embryogenesis, formation of gonad **primordia goes under the control of genes of**: a) autosomes; b) one X-chromosome; c) two X-chromosomes; d) Y-chromosomes; e) X-and Y-chromosomes.
4. The differentiation of gonads' **primordia into the gonads occurs under the control of genes of**: a) autosomes; b) one X-chromosome; c) the second X-chromosome; d) Y-chromosomes; e) cytogene.
5. In case of absence of the second gonosome in karyotype, gonads: a) are differentiated; b) are not differentiated; c) connective tissues are formed on their place; d) partially atrophy; e) completely atrophy.
6. Physical abnormality of sex the determination in humans: a) a genetic gender; b) homosexuality; c) transvestism; d) gametic gender; e) hermaphroditism.
7. Transvestism is a phenomenon, when the person: a) chooses the sexual partner of the other gender; b) chooses the sexual partner of the same gender; c) the sexual satisfaction is reached by wearing clothes of the opposite gender; d) wishes to change his/her gender; e) infertile.
8. The karyotype at Shereshevsky-Turner syndrome is :a) 46, XY, 5p-; b) 45, X0; c) 47, XXY; d) 47, XX, 21 +; e) 46, XX, 9p +.
9. The karyotype at Klinefelter syndrome is :a) 47, XXY; b) 45, X0; c) 47, XXX; d) 46, XY; e) 46, XY, 9p +.
10. A Barr's body is: a) an activated Y-chromosome; b) inactivated Y-chromosome; c) activated X-chromosome; d) inactivated X-chromosome; e) inactivated X- and Y-chromosomes.

Fill in the gaps:

1. Two Barr bodies in the nucleus of a female somatic cell are typical for the ... syndrome.
2. Female phenotype, low position of ears, short neck with a skin fold are typical for the ... syndrome.
3. Men with female phenotype, gynecomastia and impairment of spermatogenesis suffer from ... syndrome.
4. Phenomenon when sexual excitement and satisfaction are reached while wearing clothes of the opposite sex is called ...
5. Human chromosomal diseases of sex result from the impairment of the process called.
6. Characters determined by genes located in the non-homologous part of the Y-chromosome are called ...
7. Persistent discordance of person's sexual self-consciousness and his real genetic and gonad sex is called ...

PRACTICAL WORK

Task I. Solve the problems

Problem No. 1. An albino woman (autosomal recessive character) married a daltonian man (recessive X-linked character). The rest of their genotype is normal. Which combinations of genotypes and characters are possible for their children?

Problem No. 2. Genes of hemophilia (**h**) and daltonism (**d**) are located in the X chromosome at the distance of 10 centimorgans. A woman whose father is sick with both diseases and the mother don't have such genes, married a healthy man. Find the probability of giving birth to a child suffering from both diseases.

Teacher's signature

Practice 12. Topic: **FUNDAMENTALS OF HUMAN GENETICS (I)** "___"_____201___ year

Purpose of the practice: to study the purposes and the main methods of the human genetics at the present day, to learn how to solve problems in the context of composition and analysis of the family trees, finding the role of heredity in the character formation.

<p style="text-align: center;">CONTROL QUESTIONS</p> <ol style="list-style-type: none"> 1. Present tasks of human genetics. 2. Human as an object of genetic investigations. 3. Clinical-genealogical methods. 4. Twin method. Biochemical methods. 5. Cytogenetic method. The Denver and Paris classifications of human chromosomes. 6. Methods of recombinant DNA. The Human genome project. 	<p>7. Sequencing –</p>
<p style="text-align: center;">BASIC TERMS AND CONCEPTS</p> <ol style="list-style-type: none"> 1. Concordance – 2. Discordance – 3. Dizygotic twins – 4. Genealogy– 5. Monozygotic twins – 6. Proband – 	<p style="text-align: center;">TESTS FOR SELF-CONTROL</p> <ol style="list-style-type: none"> 1. Difficulties of studying human genetics are: a) simple karyotype; b) early puberty; c) small amount of offsprings; d) a plenty of offsprings; e) an experimentation opportunity. 2. The stages of genealogic analysis: a) the taking the anamnesis; b) definition of frequencies of genes and genotypes in a population; c) making genetic maps of chromosomes; d) studying the role of the environment in exhibiting character; e) analysis of a family tree. 3. Order of stages of the cytogenetic method: 1) processing of the cells by hypotonic solution NaCl; 2) staining of chromosomes; 3) stopping mitosis (with colchicine) at the stage of metaphase; 4) cultivation of cells on artificial nutrient mediums; 5) stimulation of mitosis by PHA: a) 1–5–3–4–2; b) 4–5–3–1–2; c) 4–1–5–3–2; d) 5–3–4–1–2; e) 4–5–1–3–2. 4. Holzinger’s formula is used for calculation: a) frequencies of genes and genotypes in a population; b) quotient of inheritance; c) roles of environment in exhibiting an attribute; d) probabilities of inheritance; e) degree of genetic risk. 5. What is studied by biochemical methods of human genetics? a) general blood test; b) activity of enzymes of blood plasma; c) activity of enzymes of gastric juice; d) structure of primary urine; e) spatial structure of enzymes. 6. Methods of recombinant DNA are based on: a) using mathematical expression of the law of Hardy-Weinberg; b) obtaining and sequencing DNA fragments; c) analysis of family trees; d) analysis of enzyme activity; e) microscopic examination of the karyotype.

Fill in the gaps:

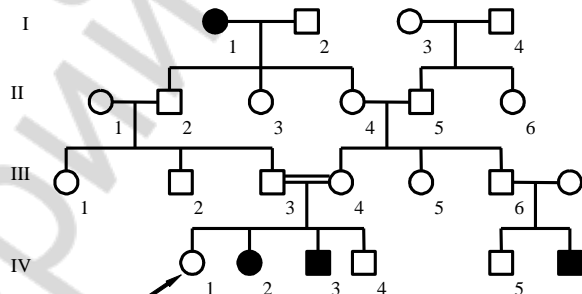
1. Man from whom medical-genetic examination of family and compiling genealogy start is called ...
2. If parents are heterozygous (complete dominance, type of inheritance is autosomal-dominant and gene penetrance 25%), then the probability of giving birth to a sick baby is ... %
3. If a mother is heterozygous and a father is healthy (X-linked dominant inheritance, gene penetrance is 40%), then the probability of giving birth to a sick baby is ... %.
4. Determining the order of nucleotides and finding a pathologic gene is possible by the method of nucleic acids' ...
5. Type of inheritance when the father transmits his character to all daughters, but neither to sons is called ...
6. Method of human genetic that allows to reveal the role of heredity and environment in the formation of a character is called ...
7. Genetic method that allows to reveal genome and chromosome mutations is called ...
8. Biochemical ... tests allow to reveal heterozygous carriers of a pathologic gene.

PRACTICAL WORK

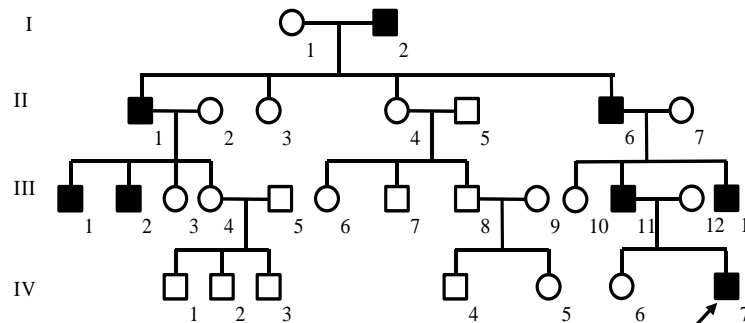
Solve the problems

Problem No. 1. The concordance of monozygotic twins according to the body weight is 80 %, and the concordance of dizygotic ones is 30 %. What is ratio of heredity and the environment in the formation of this character?

Problem No. 2. Analyze the family tree, determine the inheritance type and find the genotypes of the members.



Problem No. 3. Analyze the family tree, determine the inheritance type and find the genotypes of the members.



Teacher's signature

Practice 13. Topic: **FUNDAMENTALS OF HUMAN GENETICS (II)** "___" _____ 201___ year

Purpose of the practice: to study the methods of human genetics: modeling method, population statistics method, express methods and hereditary disease prenatal diagnostics methods, to learn to solve problems using the Hardy-Weinberg law.

<p style="text-align: center;">CONTROL QUESTIONS</p> <ol style="list-style-type: none"> 1. Characteristic of human populations. Types of marriages. 2. Genetic processes in large populations. The law of Hardy-Weinberg. 3. Genetic processes in small populations. 4. Genetic load and its biological nature. 5. Methods of prenatal diagnostics of hereditary diseases. 6. Express-methods. 	<ol style="list-style-type: none"> 6. Panmixia – 7. Population – 8. Ultrasonography –
<p style="text-align: center;">BASIC TERMS AND CONCEPTS</p> <ol style="list-style-type: none"> 1. Amniocentesis – 	<ol style="list-style-type: none"> 9. α-fetoprotein –
<ol style="list-style-type: none"> 2. Chorion biopsy – 3. Demes – 4. Genetic drift – 5. Guthrie test – 	<p style="text-align: center;">TESTS FOR SELF-CONTROL</p> <ol style="list-style-type: none"> 1. Characteristic features of an ideal population are: a) great number of individuals; b) small number of individuals; c) complete panmixia; d) absence of mutations; e) presence of mutations. 2. In mathematical expression of the Hardy–Weinberg law, p denotes the frequency of: a) dominant gene; b) recessive gene; c) dominant homozygotes; d) recessive homozygotes; e) heterozygotes. 3. In mathematical expression of the Hardy–Weinberg law, q denotes frequency of: a) dominant gene; b) recessive gene; c) dominant homozygotes; d) recessive homozygotes; e) heterozygotes. 4. In mathematical expression of the Hardy–Weinberg law, 2pq denotes frequency of: a) dominant gene; b) recessive gene; c) dominant homozygotes; d) recessive homozygotes; e) heterozygotes.

- 5. Microbiologic tests allow to:** a) build genetical maps of human chromosomes; b) determine the number of X-chromosomes; c) determine the number of Y-chromosomes; d) reveal some chromosome mutations; e) reveal some metabolism defects.
- 6. Direct noninvasive methods of prenatal diagnostics are:** a) definition of the concentration of alpha-fetoprotein; b) ultrasonography; c) chorion biopsy; d) amniocentesis; e) fetoscopy.
- 7. Optimal terms for carrying out direct noninvasive methods of prenatal diagnostics are:** a) 6–8 weeks; b) 8–10 weeks; c) 12–20 weeks; d) 23–30 weeks; e) 30–35 weeks.
- 8. The genetic load is:** a) saturation of the population by positive mutations; b) saturation of the population by mutations, reducing adaptability of individuals; c) saturation of the population by neutral mutations; d) saturation of the population by negative mutations; e) absence of mutations in populations.

Fill in the gaps:

1. Chorion biopsy is performed within ... weeks of pregnancy.
2. Predicting changes of genetic structure of human populations can be carried out by with the ... method
3. Level of α -fetoprotein in the blood of a pregnant woman ... in case of Down syndrome of the fetus.
4. Each pregnant woman compulsory undergoes ... — a direct non-invasive method of prenatal diagnostics.
5. Mother's age of over 37 years, spontaneous abortions and stillbirth in the anamnesis, children with congenital malformations are indications for carrying out ... methods of prenatal diagnostics.

PRACTICAL WORK

Solve the problems

Problem No. 1. In the USA, the 30% of persons of the examined population feel the bitter taste of phenylthiocarbamide (PTC) and the 70% do not. The ability to feel its taste is determined by the recessive gene **a**. Find out the frequency of the alleles **A** and **a** in the population.

Problem No. 2 Find out the frequency of albinos in the large African population where the concentration of the recessive pathology gene is 10%.

Problem No. 3 An aboriginal population of 127 (including children) persons lives in the jungle of the South America. The frequency of the M blood group is 64% here. Is it possible to find out the frequencies of N and MN blood groups in this population?

Teacher's signature

Practice 14. Topic: **CONTROL PRACTICE IN GENETICS** "___" _____201___ year

Purpose of the practice: to assess of the students' knowledge of genetics and the ability to solve typical problems

CONTROL QUESTIONS

1. Genetics as a science. Basic concepts of Genetics.
2. Inheritance regularities in monohybrid cross. Analyzing (test) cross.
3. Inheritance regularities in polyhybrid cross. The law of independent assortment.
4. Conditions limiting the manifestation of Mendel's laws. Pleiotropy. Semi-lethal and lethal genes.
5. Intra-allelic interaction of genes. Inheritance of blood groups.
6. Inter-allelic interaction of genes.
7. Experiments of T. Morgan. Complete and incomplete genetic linkage.
8. Autosomal and gonosomal linkage groups. Crossing-over. Basic concepts of the chromosomal theory of heredity. Maps of eukaryotes' chromosomes (genetic and cytological).
9. Variation and its types. Phenotypic variation. The reaction norm.
10. Genotypic variation and its forms. Mutagenic factors.
11. Classification of mutations. Genome, chromosome and gene mutations.
12. Stability and repair of genetic material; anti-mutagens. Biological basis of cancerogenesis.
13. Sex as a biological character. Sex characters. Sex-controlled and sex-limited characters. X- linked and holandric characters.
14. Chromosome theory of sex determination. Primary, secondary and tertiary ratios of sexes.
15. Peculiarities of sex determination in humans and its impairments.
16. Chromosomal sex diseases.
17. Present tasks of human genetics. The human as an object of genetic investigations.
18. Clinical-genealogical methods. Twin method.
19. Cytogenetic method. The Denver and Paris classifications of human chromosomes.
20. Biochemical methods.
21. Methods of a recombinant DNA. Human genome project.
22. Characteristic of human populations. Types of marriage.
23. Genetic processes in the large populations. The law of Hardy-Weinberg.
24. Genetic processes in the small populations.
25. Genetic load and its biological nature.
26. Methods of prenatal diagnosis of hereditary diseases. Express-methods.

Practice 15. Topic: **HUMAN GENETIC AND CHROMOSOMAL DISEASES** "___" _____ 2015 year

Purpose of the practice: to study the originating mechanisms, clinical symptoms, diagnostics methods of the main diseases of metabolism and the most frequent chromosome diseases, to know how to use the obtained knowledge to solve situational problems.

<p style="text-align: center;">CONTROL QUESTIONS</p> <p>1.Genic mutations as a cause of metabolic diseases. 2.Characteristic of gene human disorders. 3.Chromosomal and genome mutations as a cause of chromosomal human disorders. 4.Characteristic of chromosomal human diseases.</p>	<p>5. Syndactyilia –</p>
<p style="text-align: center;">BASIC TERMS AND CONCEPTS</p> <p>1. Hemophilia –</p> <p>2. Microphthalmia –</p> <p>3. Microcephaly –</p> <p>4. Monosomy –</p>	<p>6. Trisomy –</p> <p>7. Enzymopathy –</p> <p>8. Chromosomal diseases –</p> <p>9. Ceruloplasmin –</p> <p>10. Epicanthus –</p>

TESTS FOR SELF-CONTROL

- 1. Diagnostic symptoms of phenylketonuria are:** a) mice odor, intellect is not disturbed; b) increased muscular irritability and tone, mental retardation; c) low muscular irritability and tone, reduced skin pigmentation; d) convulsive epileptiform attacks, hemorrhages in joints; e) increased contents of phenylalanine hydroxylase in the blood.
- 2. Diagnostic symptoms of albinism are:** a) hyposensitivity to ultra-violet rays; b) milky-white skin color; c) hair depigmentation; d) hair pigmentation; e) decreased acuity of vision.
- 3. Diagnostic symptoms of galactosemia are:** a) jaundice of newborns; b) vomiting, diarrhea, hepatomegaly and splenomegaly; c) depigmentation of skin and hair; d) propensity to self-damages; e) mental retardation.
- 4. Diagnostic symptoms Wilson–Konovalov disease are:** a) increased concentration of copper in the blood; b) increased concentration of iron in the blood; c) accumulation of copper in the liver and brain leading to their degeneration; d) accumulation of iron in the liver and brain leading to their degeneration; e) impairment of functions of liver and central nervous system.
- 5. Diagnostic symptoms of hemophilia A are:** a) time of blood coagulation is 5–6 minutes; b) nasal bleedings and paralysis of legs; c) plural hematomas; d) hemorrhages in large joints and intellect decrease; e) blood in urine and high arterial pressure.
- 6. The karyotype for Patau syndrome is:** a) 47, XXY; b) 47, XX, 18+; c) 47, XXX; d) 48, XYY; e) 47, XY, 13+.
- 7. Diagnostic symptoms of Edward syndrome are:** a) macrocephaly; b) congenital heart defects; c) big lower jaw and oral opening; d) throat underdevelopment; e) rocker bottom foot.
- 8. The karyotype for Down syndrome is:** a) 45, XX, 21-; b) 47, XY, 13+; c) 47, XX, 21+; d) 47, XY, 21+; e) 46, XX, 5q-.
- 9. The karyotype for Cat cry (cri du chat) syndrome:** a) 45, XX, 5-; b) 46, XY, 5-; c) 47, XX, 18+; d) 47, XY, 5+; e) 46, XX, 5q-.

Fill in the gaps:

1. Increased concentration of copper in blood in Wilson–Konovalov disease is caused by mutation of the gene responsible for synthesis of protein ...
2. Sickle-cell anemia is caused by the mutation leading to replacement of glutamic acid with ... in 6th position of the β -chain
3. Increased level of uric acid and its salts in the organism caused by deficit of the enzyme catalyzing the addition of purine bases to nucleotides, is a symptom of a ... syndrome.
4. Hereditary deficiency of the enzyme tyrosinase leads to the ...
5. Deficit of **ceruloplasmin** results in the ... disease
6. Genetic diseases caused by the impairment of lipid exchange in the blood plasm due to defects of enzymes or cells' receptors are called ...
7. Mutations associated with changes of chromosome number or impairment of their structure cause ... diseases.
8. ... syndrome results from trisomy on the 18th pair of autosomes.

PRACTICAL WORK

Task 1. Solve the problems:

Problem 1. The parents (the wife aged 45, the husband aged 50) gave birth to a full term child. The child has a flat face, low backward-sloping forehead, big head, **upslanting palpebral fissures**, distinct epicanthus, light spots on the iris, thick lips, thick tongue protruding from the mouth, underdeveloped low ear auricles, high palate, improper growth of the teeth, unclosed interatrial septum, a single transverse palmar crease, main palmar angle 65° ; the significant mental retardation is observed.

What disease can be suspected? Which methods should be used to make a right diagnosis? What is the future viability forecast for this child? Which methods of prenatal diagnostics should be used to diagnose this disease?

Problem 2. In the family of healthy parents who are half-cousins, a full term child was born who was breast-fed by the mother. The vomit and diarrhea, jaundice, mental retardation, hepatomegalia and lien enlargement, general dystrophy, cataract gradually appeared and got stronger in the course of time.

What disease can be suspected? What laboratory research should be made? Is it possible to stop the disease progression? What is the possibility of the second ill child birth in this family?

Problem 3. Which symptoms of the listed ones are the diagnostic characters of Edwards' syndrome a) mental retardation, hepatomegaly and lien enlargement, general dystrophy, cataract; b) macrocephaly, microphthalmia, double-sided cleft of lip and palate, toe dactylion, ventricular septal defect of the heart, mental retardation; c) semiluxation of the crystalline lens, cardiac failures, tall height, long thin fingers, "funnel chest"; d) blue sclera, congenital deafness, fragility of bones; e) congenital defects, low ear auricles, elongated skull, abnormal development of the footsteps, mental retardation?

Teacher's signature

Practice 16. Topic: GENETIC COUNSELLING

_____201__ year

Purpose of the practice: to study the aims of medical genetic consulting, the stages of genetic prognosis making and indications to direct the spouses to medical genetic consulting service, principles of hereditary disease therapy, to know how to use the obtained knowledge to solve situational problems.

<p style="text-align: center;">CONTROL QUESTIONS</p> <ol style="list-style-type: none">1. The aim and tasks of genetic counselling.2. Characteristic of the stages of making genetic prognosis.3. Treatment principles of hereditary human pathology.	<ol style="list-style-type: none">5. Metabolic inhibition –6. Gene therapy –7. Substitution therapy –8. Pathogenic therapy –9. Symptomatic therapy –10. Etiotropic therapy –
<p style="text-align: center;">BASIC TERMS AND CONCEPTS</p> <ol style="list-style-type: none">1. Mild genetic risk –2. Medium genetic risk –3. High genetic risk —4. Diet therapy –	

TESTS FOR SELF-CONTROL

- The main aims of genetic counselling are:** a) **estimating** of a genetic risk degree in the examined family; b) to decrease the frequency of all diseases; c) to decrease the frequency of genetic diseases; d) to decrease the frequency of congenital malformations; e) to increase the birthrate.
- High genetic risk is:** a) up to 5 %; b) 5–10 %; c) 10–20 %; d) 20-30 %; e) about 50 %.
- Indications for directing a family to genetic counselling are:** a) presence of similar hereditary diseases at several family members; b) arrested physical **growth** of the child; c) infection disease in the family; d) parasitic disease in family; e) divorce of spouses.
- Examples of symptomatic treatment of hereditary disorders are:** a) pain killers for inflammatory processes; b) antibiotics for pain syndrome; c) sedatives for excitement; d) **excluding substance that is not metabolized in the organism from a diet**; e) surgical correcting of congenital defects.
- Hereditary diseases, corrected by special diets are:** a) Down syndrome; b) phenylketonuria; c) mucoviscidosis; d) galactosemia; e) Duchenne myodystrophy.

Fill in the gaps:

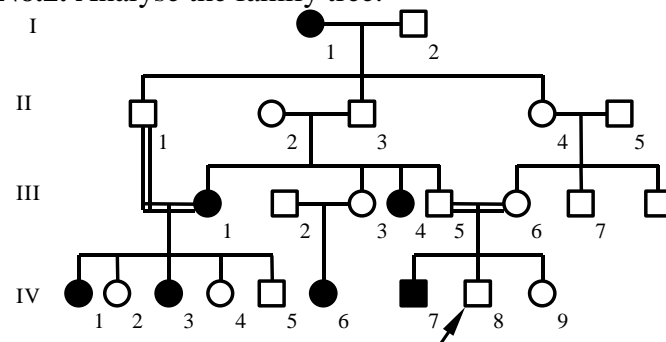
- Substitution** therapy is an example of the ... treatment of hereditary disorders.
- Dietotherapy is an example of the ... treatment of hereditary disorders.
- Prescribing anesthetics is an example of the ... treatment of hereditary disorders.
- Surgical removal of the 6-th finger is an example of the ... treatment of hereditary disorders.

PRACTICAL WORK

Task I. Solve the problems

Problem 1. The son of American banker Twister suffered from three diseases: hemophilia, daltonism and total absence of teeth. These diseases are caused by the genes located in the X chromosome. Twister junior **has been living** in Paris for many years, far away from the parents, where he died in 1944. After his death, a French woman with a 15-year-old boy came to Twister senior. The boy had hemophilia, daltonism and the absence of teeth. The woman told that this boy is a son of passed Twister junior and he was his rightful heir but the documents proving that had been lost. Despite the absence of the documents, Twister senior recognized the boy to be his grandson. The family doctor convinced him that such coincidence of three rare hereditary diseases proved that the boy was his grandson. Are you agree with the doctor's opinion?

Problem No.2. Analyse the family tree:



Define the type of inheritance. What is the probability of a sick child birth if an ill girl (IV, 1) marries a heterozygous man? What methods of prenatal diagnostics can be used for making the diagnosis of hereditary pathology of the fetus? Which recommendations should the geneticist make?

Teacher's signature

Practice 17. Topic: **REPRODUCTION OF ORGANISMS** "____"_____201__ year

Purpose of the practice: to study the reproduction as one of the universal property of the live, its ways and evolution; to study the structure of gametes, gametogenesis and the features of **human** reproduction.

<p style="text-align: center;">CONTROL QUESTIONS</p> <ol style="list-style-type: none">1. Forms of reproduction, its characteristics.2. Evolution of the sexual process.3. Structure of gametes.4. Gametogenesis (oogenesis and spermatogenesis).5. Insemination, its forms. Fertilization and its stages.6. Biological peculiarities of human reproduction.	<ol style="list-style-type: none">5. Oogenesis –6. Insemination –7. Fertilization –
<p style="text-align: center;">BASIC TERMS AND CONCEPTS</p> <ol style="list-style-type: none">1. Acrosome –2. Conjugation –3. Copulation –4. Oogamy –	<ol style="list-style-type: none">8. Partenogenesis –9. Sexual process –10. Synkaryon –11. Spermatogenesis –

TESTS FOR SELF-CONTROL

- Characteristics of asexual reproduction is:** a) two individuals participate in reproduction; b) only one individual participates in reproduction; c) the genotype of daughter individual differs from parental ones; d) genotype of daughter individuals are identical to parental ones; e) the number of daughter individuals increases slowly.
- Forms of asexual reproduction of multicellular organisms are:** a) reproduction via vegetative organs; b) conjugation; c) copulation; d) polyembryony; e) fragmentation.
- Characteristics of sexual reproduction is:** a) two individuals participate in reproduction; b) only one individual participates in reproduction; c) genotypes of daughter individual differs from parental ones; d) genotypes of daughter individuals are identical to parental ones; e) the number of daughter individuals increases quickly.
- Characteristics of sexual reproduction is:** a) two individuals participate in reproduction; b) only one individual participates in reproduction; c) genotypes of daughter individual differs from parental ones; d) genotypes of daughter individuals are identical to parental ones; e) the number of daughter individuals increases quickly.
- Characteristics of isolecithal ova:** a) contains a lot of yolk; b) a little of yolk; c) the yolk is **uniformly** distributed; d) the yolk is concentrated on the vegetative pole; e) the yolk is located at the animal pole.
- Movement forward of spermatozoons in the female reproductive tracts is provided by:** a) mobility of spermatozoons; b) ovum's immobility; c) contraction of uterine muscles; d) excretion of **gynogamones**; e) contraction of **abdominal** muscles.
- Fertilization stages are:** a) destruction of the ova by spermatozoons' hyaluronidase; b) acrosome reaction; c) splitting of the ovum; d) **entrance** of head, neck and tail of the spermatozoon into the ovum's cytoplasm; e) maturation of pronuclei.
- Features of human reproduction are:** a) women are capable for reproduction **since** the puberty till advanced age; b) men are capable for reproduction **since** the puberty up to 50 years; c) one oocyte of the second order is formed ones a moon month in women; d) spermatozoons are formed periodically in men; e) the older is the man, the longer is the time between the gamete's meiosis I and II.

Fill in the gaps:

- Exchange of genetic information between individuals of one species is called...
- Confluence of female and male pronuclei during fertilization is called...
- Sexual reproduction** without fertilization is called...
- Ovum containing a lot of yolk **concentrated at** one of the poles is called... ..
- Gametes contributing to spermatozoon's fixation on the ovum's membrane are called

PRACTICAL WORK

Task I. Solve the problems

Problem No.1. Upon the parthenogenesis the organism is developing from unfertilized ovum. Why can't a spermatozoon give the beginning to a new organism without fertilization?

Problem No.2. A planaria is a hermaphrodite and can multiply by self-fertilization. Besides, it is able multiply asexually. Is the genotype of the descendants of one individual same if one descendant is formed by self-fertilization and the other one by asexual reproduction?

Teacher's signature

Practice 18. Topic: **FUNDAMENTALS OF ONTOGENESIS (EMBRYONIC DEVELOPMENT)** "___"___201__ year

Purpose of the practice: to get acquainted with periods of ontogenesis; to study and the stages of embryogenesis, critical periods and their reasons, the mechanisms of genetic information realization during the prenatal period.

<p style="text-align: center;">CONTROL QUESTIONS</p> <ol style="list-style-type: none"> 1. Ontogenesis, its types, division into periods. 2. Characteristic of pro-genesis. 3. Division of the human embryonic development into periods. 4. Characteristic of embryogenesis stages. Provisional organs. 5. Realization of genetic information in the prenatal period. 6. Mechanisms of embryogenesis. Morphogenesis. 7. Critical periods of the prenatal ontogenesis. Teratogenesis. 	<ol style="list-style-type: none"> 6. Progenesis – 7. Embryonic induction –
<p style="text-align: center;">BASIC TERMS AND CONCEPTS</p> <ol style="list-style-type: none"> 1. Aplasia – 2. Atresia – 3. Balstula – 4. Gradient of physiologic activity – 8. Critical periods – 9. Morphogenetic fields – 	<p style="text-align: center;">TESTS FOR SELF-CONTROL</p> <ol style="list-style-type: none"> 1. The type of zygote cleavage depends on: a) sizes of the ovum; b) shape of the ovum; c) volume of yolk; d) distribution of yolk in the cytoplasm; e) potentialities of ovum's cytoplasm. 2. Derivatives of the dermatome are: a) epithelium of the gut; b) nervous system; c) respiratory system; d) urinogenital system; e) dermis. 3. First causes of cells differentiation during embryogenesis are: a) chemical homogeneity of the ovum's cytoplasm; b) chemical heterogeneity of the ovum's cytoplasm; c) chemical homogeneity of spermatozoon's cytoplasm; d) chemical heterogeneity of spermatozoon's cytoplasm; e) different potentials of animal and vegetative poles of the ovum. 4. Realization sequence of genes' action during the ontogenesis is: a) DNA → enzyme → mRNA → biochemical reaction → character; b) DNA → mRNA → enzyme → biochemical reaction → character; c) other genes have an impact on manifestation of the character; d) other genes do not influence the manifestation of the character; e) environmental factors do not influence the manifestation of the character. 5. Characteristic attributes of totipotent cells are: a) their development is programmed; b) their development is not programmed; c) each of them can give rise to any phylum of cells; d) each of them can give rise only to the certain phylum of cells; e) the majority transcriptions are blocked.

Fill in the gaps:

1. **Mitotic divisions** of a zygote and blastomeres during the initial stage of embryogenesis is called...
2. Period of human embryonic development from the 4th week to the end of the 8th week is called...
3. Method of gastrulation when some cells of blastoderm move into the blastocoel to multiply there and **form** the second layer of cells is called...
4. Organisms, in which blastopore transforms into the anal opening and the mouth forms on the opposite side of the body, are called...
5. A primal cause of cells differentiation in the of embryogenesis is ... of the ovum cytoplasm.
6. Gradual decrease of metabolism intensity in fetus from its head to the **caudal** part is called ... of physiological activity.

PRACTICAL WORK

Task 1. Study the preparation, colour the pictures, and sign the indications:

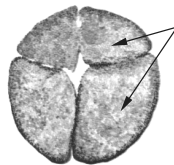


Fig.1. Cleavage of a frog ovum (7x8): 1 – blastomeres

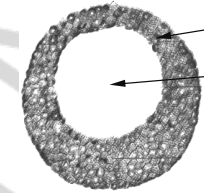


Fig.2. Frog's blastula (7x8): 1 – blastomeres, 2 – blastocoel

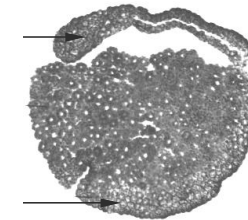


Fig.3. Frog's gastrula (7x8): 1 – dorsal lip of blastoporus, 2 – ventral lip of blastoporus

Task II. Solve the problems

Problem No.1 Why is the frequency of meiosis disturbances occurring in the ovogenesis increases rapidly with the person's age and much slower in the spermatogenesis?

Problem No. 2 Embryos that have extra chromosomes keep alive during the zygote cleavage but after that the most of them die. How can you explain their survivability during the cleavage?

Teacher's signature

Учебное издание

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МЕДИЦИНСКАЯ БИОЛОГИЯ

MEDICAL BIOLOGY

Практикум для иностранных студентов 1-го года обучения по специальности «Стоматология»

На английском языке

3-е издание, исправленное

Ответственный за выпуск В. Э. Бутвиловский
Переводчик Т. Ф. Данилова

Подписано в печать 17.03.16. Формат 60×84/8. Бумага офсетная.

Ризография. Гарнитура «Times».

Усл. печ. л. 13,02. Уч.-изд. л. 7,0. Тираж 115 экз. Заказ 252.

Издатель и полиграфическое исполнение: учреждение образования
«Белорусский государственный медицинский университет».

Свидетельство о государственной регистрации издателя, изготовителя,
распространителя печатных изданий № 1/187 от 18.02.2014.

Ул. Ленинградская, 6, 220006, Минск.