ANTI-TUBERCULOSIS AND ANTI-LEPROSY DRUGS

A. Actuality. Mycobacteria, including mycobacteria of tuberculosis and leprosy, constitute a group of microorganisms characterized by structural components of the cell wall and energy metabolism. Antituberculosis drugs constitute a specific group that includes synthetic antibiotics and chemotherapeutics used in the treatment of sensitive and resistant tuberculosis. The high incidence of tuberculosis and the resistance of mycobacteria worldwide, the complex and long-term treatment require deep knowledge in the field of the pharmacology of antituberculosis drugs and the principles of association. Leprosy, although a pathology not characteristic of the republic, can present a danger as a result of migration, and knowledge in this aspect is necessary to be able to deal with it in the event of its detection.

B. The purpose of the training consists in familiarizing the students with the pharmacology of anti-tuberculosis and anti-leprosy drugs, the possibilities of using rational chemotherapeutic combinations, depending on the forms and evolution of the disease, the duration of the treatment.

C. Learning objectives:

1) The student must **know:** classification and name of drugs, pharmacokinetics and pharmacodynamics of anti-tuberculosis and anti-leprosy drugs, principles of pharmacotherapy.

2) The student must **be able to:** prescribe anti-tuberculosis and anti-leprosy drugs in the basic medicinal forms and indicate them according to the form of the disease.

D. The initial level of knowledge required for interdisciplinary integration:

Organic chemistry. The structure of antituberculosis drugs.

Microbiology . Mycobacteria: microbiological characteristics. The tubercle bacillus. The development of resistance. Chemoprophylaxis and immunoprophylaxis of tuberculosis.

E. Self-training questions:

1. Antituberculosis drugs: classification by group membership, mechanism of action acording to WHO. Mechanisms of action.
2. Ansamycins: spectrum and mechanism of action, indications, side effects.
3. Hydrazides of isonicotinic acid: mechanism of action, indications, side effects.
4. Butanol and nicotinamide derivatives: mechanism of action, indications, side effects.
5. Antituberculosis antibiotics: mechanism of action, indications, side effects.
6. Fluoroquinolones and oxazolidinones as antituberculosis: mechanism of action, indications, side effects.
7. New antituberculosis drugs: mechanism of action, indications, side effects.
8. Anti-leprosy drugs: classification, mechanism of action, indications, side effects.

F. Independent work (points 2, 3 and 4 is done in writing form while preparing for the lesson)

1.) Brief characteristics of compulsory drugs: (Medicinal form. Method of administration. Doses (maximum for one administration, for 24 hours, therapeutic). Mechanism of action. Indications. Contraindications. Side effects.)

1. Isoniazid. 2. Ethambutol. 3. Streptomycin. 4. Pyrazinamide. 5. Levofloxacin. 6. Dapsone. 7. Rifampicin. 8. Clofazimine.

2.) Questions on medical prescriptions. **(**is done in writing form while preparing for the lesson)

To prescribe the following drugs in all medicinal forms:

1. Isoniazid. 2. Ethambutol. 3. Streptomycin. 4. Pyrazinamide. 5. Levofloxacin. 6. Dapsone. 7. Rifampicin. 8. Clofazimine.

List the groups and drugs used in (for): tuberculous meningitis, tuberculosis prophylaxis, active pulmonary tuberculosis, resistant tuberculosis, leprosy.

3.) Tests (Guidelines for Laboratory Work in Pharmacology).

4.) Tables (recapitulation of knowledge)

Table 1

Determine the antituberculosis drugs

Drugs	Way of administration	Mechanism of action	Half-life	Dyspeptic disruptions	Super-infections	Hearing loss
A	parenteral	Inhibition of protein synthesis	2 – 3	-	+	+
B	internal	Para-aminobenzoic acid competitive antagonist	2 – 3	+	-	-
C	internal	RNA synthesis inhibition	2 – 5	+	+	-
D	internal	Mycolic acid synthesis inhibition	Aceylators fast 0,5 – 1,6 slow: 2 – 4	-	-	-

G. Interactive activity

1. **Experimental and virtual didactic film** (elaboration of minutes, conclusions).
2. **Clinical case** (Guidelines for Laboratory Work in Pharmacology).
3. **Virtual situations** (Guidelines for Laboratory Work in Pharmacology).
4. **Situation problem:**

1. For the complex treatment of patients with pulmonary tuberculosis, 4 drugs were used. Against the background of the treatment, some side effects were observed:
Drug A - hearing loss and kidney damage.
Drug B - peripheral neuritis and increased transaminases.
Medication C - red-orange staining of urine and increased transaminases.
Drug D - optic nerve damage and increased uric acid.
Which antituberculosis drugs can cause complications?
List other side effects that may occur with those drugs.

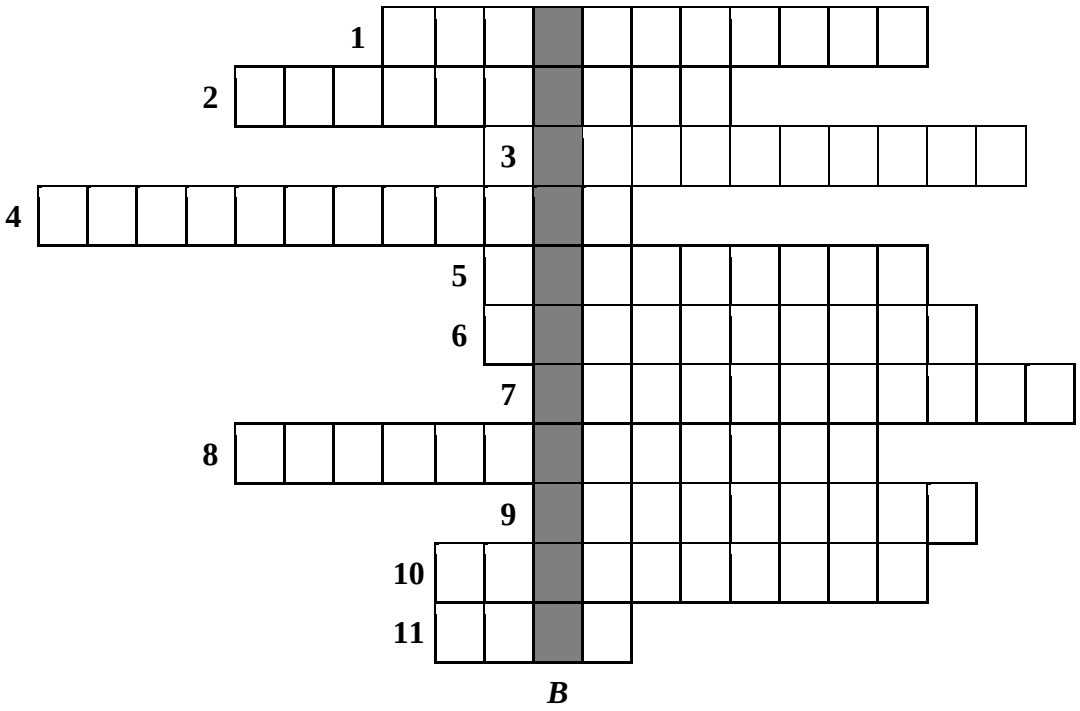
2. The patient was administered the following drugs:
Rp.: Isoniazid 0.3
D.t.d. N. 50 in tabl.
S. Internaly. 2 tablets/day, 3 days a week.
#
Rp.: Rifampicin 0.15
D.t.d. N. 30 in caps.
S. Internaly. One tablet/day, 3 days a week.

Indicate the groups of antimicrobial drugs prescribed in the prescriptions.
Explain the purpose of indicating this combination.
Explain the mechanism of action of the prescribed drugs.
Inform the patient about possible side effects.

5. **Crosswords**

A→B The main component of the tubercle bacillus wall.

A



B

1. Bacteriostatic antibiotic that colors secretions red.
2. Fluoroquinolone used as an antituberculosis drug.
3. Selective chemotherapy only for Koch bacillus.
4. Nicotinamide derivative.
5. Aminoglycoside antibiotic used as an antituberculosis drug.
6. Vitamin used to prevent side effects of isoniazid.
7. Antituberculosis drug whose mechanism is inhibition of the cell wall.
8. Antituberculosis antibiotic with specific bacterial origin.
9. What makes rifampicin red.
10. Nicotinamide derivative that is partially absorbed from the digestive tract.
11. Another name for the tuberculosis agent.

No.	***The name of the drugs***	***Forms of delivery***
1	**Pyrazinamide**	Tablet 0.5
2	**Dapsone**	Tablet 0.05 ; 0.1
3	**Ethambutol**	Tablet 0.1 ; 0.4
4	**Isoniazid**	Tablets 0.1 ; 0.2 Sol. 10% - 5ml in ampoules
5	**Levofloxacin**	Tablets 0.25; 0.5 Sol.0.5% - 100ml in to the vials Eye drops 0.5% - 5ml
6	**Rifampicin**	Tablets / Capsules 0.15 ; 0.3 Powder 0.15 ; 0.6 in vials
7	**Clofazimine**	Capsules 0.05; 0.1
8	**Streptomycin**	Powder 0.25 ; 1.0 in vials

ANTIPROTOZOIC DRUGS

A. Actuality. Protozoa are pathogens that cause a range of diseases with a more or less specific clinical picture. Antiprotozoal drugs form a large group of substances with specific action on the parasite depending on its location and the form of the disease caused by it. In order to achieve an effective treatment, a deep knowledge of the pharmacology of the drugs in

this group is necessary.

B. The purpose of the training consists in familiarizing the students with the chemotherapeutics active in malaria, amebiasis, trichomonosis, giardosis, toxoplasmosis, leishmaniasis, balantidiasis by highlighting their general and specific properties against the parasitic agent.

C. Learning objectives:

1) The student must **know:** classification, spectrum and mechanism of action, indications, adverse reactions, principles of prophylaxis of clinical manifestations of antiprotozoal drugs, as well as prevention of contamination with the respective agents.

2) The student must **be able to:** prescribe the mandatory antiprotozoal drugs, indicate the respective drugs depending on the form of the disease and the location of the parasite, as well as the drugs used in the chemoprophylaxis of parasitic diseases.

D. Initial level of knowledge required for interdisciplinary integration:

Biology. Parasitism. The specificity of parasitic environment. Classification. Protozoa types. Characteristics. Class sarcodae. Amoebic dysyntery, intestinal amoeba. Class flagellae. Leishmania. Class trichomonada. Lamblia. Trypanosoma. Class sporaceae. Toxoplasma. Plasmodium species. Class infuzoriae. Balantiditia. Morphofunctional characteristics of protozoa, development cycle, pathogenic action.

E. Self-training questions:

1. Classification of antiprotozoal drugs.
2. Antimalarial drugs: classification according to plasmodium forms, mechanisms of action, indications, side effects.
3. Drugs used in amoebiasis: classification, mechanisms of action, indications, side effects.
4. Drugs used in trichomonadosis: mechanism of action, indications, side effects.
5. Dugs used in giardiasis: mechanism of action, indications, side effects.
6. Drugs used in the treatment of toxoplasmosis, trypanosomiasis and pneumocystosis: classification, mechanisms of action, indications, side effects.
7. Drugs used in the treatment of balantidiasis and leishmaniasis: mechanisms of action, indications, side effects.

F. Independent work (points 2, 3 and 4 is done in writing form while preparing for the lesson)

1) Brief characteristics of compulsory drugs: (Pharmaceutical form. Method of administration. Doses (maximum for one administration, for 24 hours, therapeutic). Mechanism of action. Indications. Contraindications. Side effects)

1. Pentamidine. 2. Pyrimethamine. 3. Chloroquine. 4. Metronidazole. 5. Solusurmine. 6. Co-trimoxazole. 7. Azithromycin. 8. Doxycycline.

2) . Questions on medical prescriptions. (is done in writing form while preparing for the lesson)

To prescribe the following drugs in all medicinal forms:

1. Pentamidine. 2. Pyrimethamine. 3. Chloroquine. 4. Metronidazole. 5. Solusurmine. 6. Co-trimoxazole. 7. Azithromycin. 8. Doxycycline.

List the groups and drugs used in (for): malarial coma, attacks of malaria, treatment (eradication) of malaria, individual prophylaxis of malaria, social prophylaxis of malaria, prophylaxis of malaria relapses, amoebiasis of any location, amoebiasis in the intestinal lumen and wall, amoebiasis tissue, giardiasis, trichomonadosis, toxoplasmosis, balantidiasis, leishmaniasis, trypanosomiasis, pneumocystosis.

3.) Tests (Guidelines for Laboratory Work in Pharmacology).

4.) Tables (recapitulation of knowledge)

Table 1

The spectrum of action of some antimalarial drugs

Drugs	Blood	Liver	Blood	Blood

	Sporozoites	Paraerythrocytic forms	Preerythrocytic forms	Erythrocyte forms	Sexual forms
Chloroquine					
Quinine					
Primaquine					
Pyrimethamine					
Sulfanilamides					

Note. note the presence of the effect with the "+" sign.

Table 2

Indications of antimalarial drugs

Directions	Chloroquine	Quinine	Primaquine	Pyrimethamine
Access to malaria				
Individual chemoprophylaxis				
Social chemoprophylaxis				
Treatment (eradication) of malaria				
Prevention of relapses				

Note: note the presence of the effect with the "+" sign.

Table 3

Select the site of action of the drugs used in amoebiasis

Drugs	Drugs used in intestinal amoebiasis			Drugs used in extraintestinal forms
	With action at the level of the intestinal lumen	With action at the level of the intestinal mucosa layer	What depresses the normal intestinal flora	
Metronidazole				
Emetine				
Chinophone				
Chloroquine				
Tetracycline				

Note: note the presence of the effect with the "+" sign.

G. Interactive activity

1. **Experimental and virtual didactic film** (elaboration of minutes, conclusions)
2. **Clinical case** (Guidelines for Laboratory Work in Pharmacology).
3. **Virtual situations** (Guidelines for Laboratory Work in Pharmacology).
4. **Situation problem**

A patient with malaria was prescribed a medicine, 1 tablet 3 times a day. To accelerate the effect, the self-supporting patient started using the drug 2 tablets 3 times a day. On the 4th day of treatment, the patient experienced psychological disturbances: verbal and motor excitability, unmotivated actions, hallucinations. A yellowish coloring of the skin and integuments is determined.

What medication was prescribed to the patient?

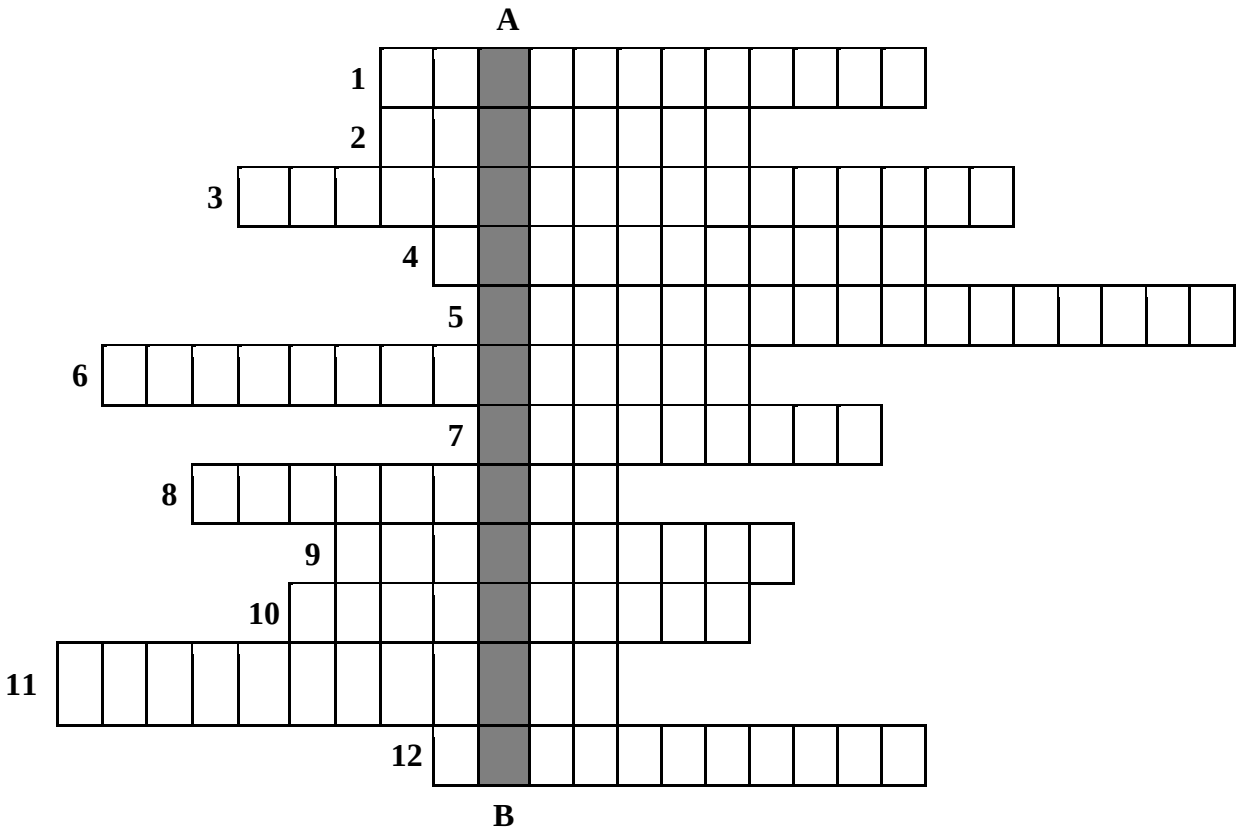
What was the cause of the mental disorders?

5. **Crosswords**

A→B Protozoan infection that is mainly transmitted from cats and affects pregnant women.

1. The most used antiprotozoal drug.

2. A species of mosquito that spreads malaria.
3. Antimalarial that inhibits nucleic acid synthesis.
4. Medicinal drugs used in leishmaniasis.
5. Species of protozoa that affect the lungs.
6. Broad-spectrum antibiotic group used as an antiprotozoan with serious teratogenic effects.
7. Are antimalarials still used in pathology...?
8. Nitroimidazole derivative drug.
9. Antimalarial tissue schizontocid.
10. Antimalarial quinoline derivative.
11. Trimethoprim+sulfamethoxazole = ?
12. Group of antibiotics used in toxoplasmosis.



No.	*The name of the drugs*	*Forms of delivery*
1	**Chloroquine**	Tablets 0.25 Sol. 0.5% - 5ml in ampoules
2	**Co-trimoxazole Sulfamethoxazole:Trimethoprim = 5:1**	Tablets 0.24; 0.48 Suspension 80ml (0.24/5ml) Sol. 5 ml in ampoules
3	**Doxycycline**	Capsules 0.1
4	**Azithromycin**	Tablets 0.25 and 0.5 Suspension 20 ml (0.1/5 ml) in vials
5	**Metronidazole**	Tablets 0.2; 0.4 Vaginal tablets 0.5 Vaginal suppositories 0.5; 1.0 Sol. 0.5% - 10ml in ampoules Sol. 0.5% - 100ml in vials (i/v)
6	**Pentamidine**	Powder 0.2; 0.3 in vials

7	**Pyrimethamine**	Tablet 0.025
8	**Solusurmine**	Sol. 20% - 10ml in ampoules

ANTIHELMINTIC DRUGS

A. Actuality. Helminthiasis, diseases caused by parasitic worms, are quite common, especially in children, and are often asymptomatic. Their treatment, in most cases, is empirical due to the difficulties of diagnosis. The selection of anthelmintic preparations depends on the type of parasitic agent and its location, a deep knowledge of the spectrum of action and the principles of their use is required.

B. The purpose of the training is to familiarize students with the pharmacological properties of anthelmintic drugs.

C. Learning objectives:

1) The student must **know:** the principles of classification, the spectrum and mechanism of action, the indications, the side effects and the particularities of dosing of anthelmintic drugs.

2) The student must **be able to:** prescribe mandatory anthelmintic drugs in prescriptions, indicate the drugs in different helminthiasis.

D. Initial level of knowledge required for interdisciplinary integration:

Biology. The term of the helminth. Types of helminths. Flatworms. Trematoda. Fasciola hepatica, cat's two-mouth, lanceolate trematode, pulmonary trematode. Class cestoda: taenia saginata (beef tapeworm), taenia solium (pork tapeworm), small tapeworm. The cycle of development. Cylindrical worms. Ascarids, development cycle.

E. Self-training questions:

1. Classification of anthelmintic drugs.
2. Drugs used in intestinal nematodes: spectrum and mechanisms of action, indications, contraindications and side effects.
3. Medicines used in intestinal cestodoses: spectrum and mechanisms of action, indications, contraindications and side effects.
4. Medicines used in extraintestinal helminthiasis: spectrum and mechanisms of action, indications, contraindications and side effects.

F. Independent work (points 2, 3 and 4 is done in writing form while preparing for the lesson)

1) Brief characteristics of compulsory drugs: (Pharmaceutical form. Method of administration. Doses (maximum for one administration, for 24 hours, therapeutic). Mechanism of action. Indications. Contraindications. Side effects)

1. Levamisole. 2. Mebendazole. 3. Pyrantel. 4. Albendazole. 5. Niclosamide. 6. Praziquantel. 7. Diethylcarbamazine. 8. Ivermectin.

2) . Questions on medical prescriptions.(is done in writing form while preparing for the lesson)

To prescribe the following drugs in all medicinal forms:

1. Levamisole. 2. Mebendazole. 3. Pyrantel. 4. Albendazole. 5. Niclosamide. 6. Praziquantel. 7. Diethylcarbamazine. 8. Ivermectin.

List the groups and drugs used in (for): ascaridosis, enterobiosis, tricocephalosis, hookworm, strongyloidosis, taeniasis, botryocephalosis, teniarynchosis, extraintestinal helminthiasis.

3.) Tests (Guidelines for Laboratory Work in Pharmacology).

4.) Tables (recapitulation of knowledge)

Table1

Indicate the drugs according to the type of helminths

The type of helminthiasis	Types of helminths	Get ready

	(causative agent)	
Intestinal:		
I. *Nematodes:*	**Nematodes:**	
Ascariasis	*Ascaris lumbricoides*	
Trichuriasis	*Trichocephalus trichiurus*	
Hookworm disease	*Strongyloides stercoralis*	
Enterobiosis	*Entero bius vermicularis*	
Strongiloidosis	*Strongyloides stercoralis*	
II. *Cestodes:*	**Cestodes:**	
Diphyllobothriasis	*Diphyllobothrium latum*	
Botryocephaphosis	*Bothriocephalus acheilognathi*	
Teniosis	*Taenia solium*	
Teniarynchosis	*Taeniarhynchus saginatus*	
Extraintestinal:		
I. *Nematodes:*	**Nematodes:**	
Filariasis	*Wuchereria bancrofti*	
Trichinosis	*Trichinella spiralis*	
II. *Trematodes:*	**Trematodes**	
Fascioliasis	*Fasciola hepatica*	
Opisthorchosis	*Opisthorchis felineus*	
Schistosomiasis	*Schistosoma haematobium*	

Table 2

Mechanism of action of antihelmintic drugs.

The mechanism of action (on helminths)	Mebenda zole	Levami-soil	Niclosa-mida	Praziquan -tel	Albendaz ole	pyrantel
Dysregulation of the function of the neuromuscular system						
Dysregulation of energy processes						
Dysregulation of tubulin synthesis and polymerization						
Disorder of calcium metabolism						
Decreasing the resistance of helminths to proteolytic enzymes						

G. Interactive activity

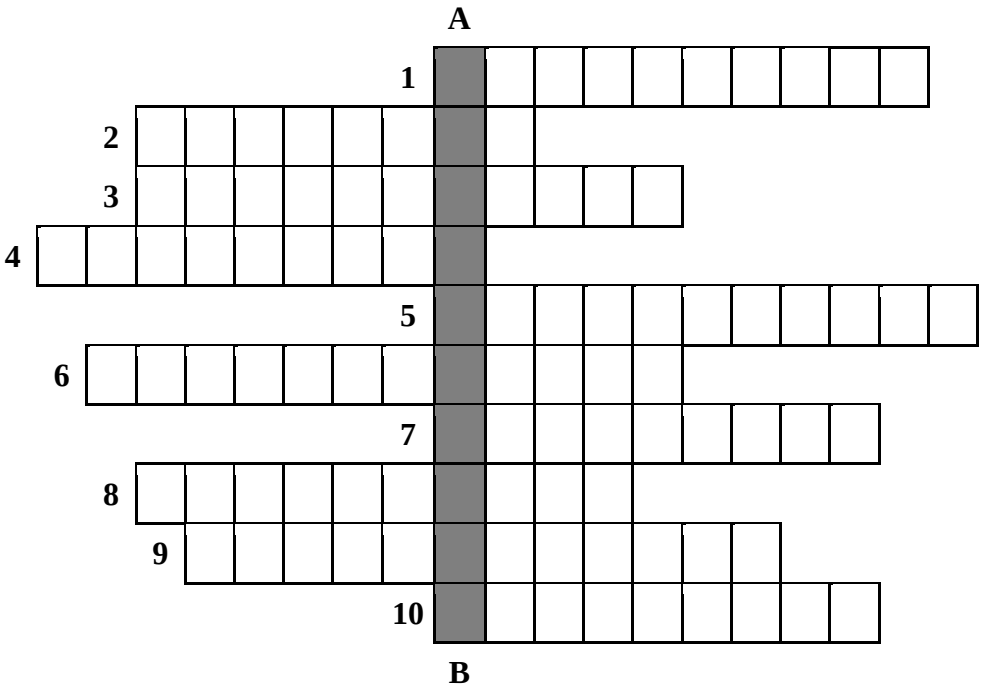
1. **Experimental and virtual didactic film** (elaboration of minutes, conclusions)
2. **Clinical case** (Guidelines for Laboratory Work in Pharmacology).
3. **Virtual situations** (Guidelines for Laboratory Work in Pharmacology).
4. **Situation problem**

One patient was prescribed a medicine for the treatment of ascariasis. Usually the drug is indicated for mass deworming. Mechanism of action consists in the paralysis of the neuromuscular apparatus of the helminths. It is prescribed without use of laxatives and following a special diet.

Determine the patient's prescribed medication.

5. Crosswords

A→B Antihelminthic drug that is slightly absorbed in the intestines, having a bioavailability of 10%.



1. Anthelmintic active against extraintestinal cestodes.
2. Anthelmintic active against intestinal nematodes.
3. One of the most common intestinal nematode helminthiasis.
4. The effect of pyrantel on the musculature of helminths.
5. It inhibits oxidative phosphorylation and stimulates ATP-ase of helminths.
6. Antiprotozoal drug with anthelmintic effect.
7. Anthelmintic that can be used in extraintestinal cestodes and trematodes.
8. An anthelmintic used mainly in ascariasis.
9. Parasitosis that mainly affects the parenchymal organs.
10. Anthelmintic with immunostimulating properties.

No.	***The name of the drugs***	***Forms of delivery***
1	**Albendazole**	Tablet 0.4
2	**Diethylcarbamazine**	Tablet 0.05; 0.1
3	**Ivermectin**	Tablet 0.006
4	**levamisole**	Tablet 0.05 ; 0.15
5	**Mebendazole**	Tablet 0.1 Suspension 2% - 30ml in vials
6	**Niclosamide**	Tablet 0.25
7	**Pyrantel**	Tablet 0.25
8	**Praziquantel**	Tablet 0.6