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PHARMACOLOGY AND CLINICAL PHARMACOLOGY**

**Methodological Guidelines
for Laboratory Works
in Pharmacology**

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VI. ANTIMICROBIAL, ANTIPARASITIC AND ANTIHELMINTIC DRUGS

ANTISEPTICS AND DISINFECTANTS. SULFONAMIDES. ANTIBACTERIAL CHEMOTHERAPEUTIC DRUGS WITH DIFFERENT CHEMICAL STRUCTURES.

A. Actuality. Approximately 50% of human diseases are caused by various pathogens: bacteria, spirochetes, rickettsii, chlamydia, protozoa, fungi, viruses, etc. In the fight against pathogens, located on a living tissue (skin, mucous membranes, natural and pathological cavities, wounds) or in the external environment (various objects, instruments, etc.), drugs are used, which can prevent their multiplication or cause their destruction - antiseptics and, respectively, disinfectants. These drugs are used on a large scale in the medical and sanitary institutions. Especially, they are an essential part of infection control practices and help prevent nosocomial infections.

In the infection treatment, along with antibiotics, are used a varied arsenal of drugs like sulfonamides and chemotherapeutics with diverse chemical structure. These can often be considered as alternative of antibiotics or even first line drugs in the treatment of infectious diseases, such as the induced by protozoa, chlamydia, rickettsia, etc.

B. The purpose of training: to familiarize students with the pharmacology of antiseptics, disinfectants, sulfonamides, antibacterial chemotherapeutic agents with diverse chemical structures, and to develop skills for selecting these medications in medical practice.

C. Learning objectives:

- 1) The student **must know:** definition, classification, drug forms and routes of administration, mechanism of action, indications, contraindications and adverse reactions of the antiseptic drugs, disinfectants, sulfonamides, chemotherapeutics with diverse chemical structure.
- 2) The student **must be able to:** prescribe antiseptic drugs, disinfectants, sulfonamides, chemotherapeutics with diverse chemical structure in all medicinal forms and select drugs according to the indications.

D. Knowledge of previous and related disciplines necessary for interdisciplinary integration.

Microbiology. Bacterial taxonomy and nomenclature. Morphological types of bacteria. Bacterial ultrastructure. Chemical composition, biological functions, and methods of identification of obligatory and facultative structural elements. Bacteriological examination: essence of the stages and practical application. Mycetes, viruses, bacteria, fungi, protozoa – taxonomy and nomenclature. Concepts of asepsis and antisepsis. Main antiseptic substances.

E. Self-training questions:

1. Antiseptics and disinfectants: definition, classification by chemical structure. The basic requirements for antiseptics and disinfectants, the mechanisms of action. Factors that determine antimicrobial activity and drug selection.
2. Oxidant agents: mechanisms of action, effects, indications, and adverse reactions. Halogenated compounds: classification.
3. Halogenated compounds. Chlorine-containing drugs: mechanism of action, effects, indications, and adverse reactions.
4. Iodine drugs: mechanism of action, effects, indications, adverse reactions.
5. Metal compounds: mechanisms of action, effects, and indications. Local action (astringent, irritant, and cauterizing).
6. Detergents. Anionic detergents: mechanism of action, effects, indications.
7. Cationic detergents: mechanism of action, effects, indications.

8. Aldehydes: mechanism of action, effects, indications.
9. Phenols: mechanism of action, effects, indications.
10. Colorants: mechanisms of action, particularities of use .
11. Nitrofurans derivatives: mechanism of action , effects , indications .
12. Acids and the bases. Volatile oils: mechanisms of action, effects, indications.
13. Bisguanides: mechanism of action, effects, indications.
14. Alcohols: mechanism of action, effects, indications.
15. Thiosemicarbazone derivatives: mechanism of action, effects, indications.
16. Naphthoquinone (nucine) derivatives: mechanism of action, effects, indications.
17. Sulfonamides: classification, spectrum and mechanism of action, indications, contraindications, adverse reactions, pharmacokinetics.
18. Combined sulfonamides: composition, spectrum and mechanism of action, indications, contraindications, adverse reactions, pharmacokinetics.
19. Azo-compounds: composition, mechanism of action, indications. Mesalazine particularities.
20. Nitrofurans derivatives: classification, spectrum and the mechanism of action , the indications and adverse reactions .
21. Naphthylidine and quinolone derivatives. The non- fluorinated quinolones: the spectrum and mechanism of action, indications, pharmacokinetics.
22. Fluoroquinolones: classification, spectrum and mechanism of action, indications, contraindications, adverse reactions, pharmacokinetics.
23. Nitroimidazole: classification, spectrum and the mechanism of action, indications and adverse reactions, pharmacokinetics.
24. Oxazolidinones: the spectrum and mechanism of action, indication , adverse reactions, pharmacokinetics.
25. 8-oxyquinoline derivatives: classification, spectrum and mechanism of action. Indications, adverse reactions.
26. Quinoxalines derivatives: the spectrum and mechanism of action, indications, adverse reactions.

F. Independent work (is done in written form while preparing for the lesson)

1) Medical prescription exercises

To prescribe the following drugs in all medicinal forms: 1. Nitrofurantoin. 2. Silver nitrate. 3. Zinc sulfate. 4. Alcoholic iodine solution of 5%. 5. Hydrogen peroxide solution. 6. Potassium permanganate. 7. Ethyl alcohol. 8. Boric acid. 9. Nitrofurantoin. 10. Metronidazole. 11. Brilliant green. 12. Chlorhexidine. 13. Cetylpyridinium. 14. Linesolid. 15. Hexamethylenetetramine. 16. Sulfadimethoxine. 17. Sulfacetamide. 18. Nitrofurantoin. 19. Ciprofloxacin. 20. Co-trimoxazole. 21. Phthalylsulfathiazole. 22. Sulfasalazine . 23. Nalidixic acid. 24. Ofloxacin. 25. Furasolidon

No.	<i>The name of the medicine</i>	<i>Form of delivery, dosage</i>
1.	Sulfadimethoxin	Tablets 0.2; 0.5
2.	Co-trimoxazole Sulfamethoxazole : Trimethoprim = 5:1	Tablets 0.24; 0.48 Suspension 80ml (0.24/5ml) Sol. 5 ml in amp.
3.	Nalidixic acid	Tablet and capsule 0.5
4.	Ofloxacin	Tablets 0.2; 0.1 Sol. 0.2% - 100ml in the vials (i/v)

		Eye drops 0.3% - 5ml Ophthalmic ointment 0.3% - 3.0
5.	Metronidazole	Tablets 0.2; 0.4 Vaginal tablets 0.5 Vaginal suppositories 0.5; 1.0 Sol. 0.5% - 10ml in amp. Sol. 0.5% - 100ml in vials (i/v)
6.	Nitroxoline	tablet 0.05
7.	Linezolid	Sol. 0.2% - 300ml in vials (i/v) Tablets 0.6
8.	Ciprofloxacin	Tablets 0.25; 0.5 Sol. 1% - 10ml in amp. Sol. 0.2% - 100ml in the vials (i/v) Ophthalmic sol. 0.1% - 10ml Ophthalmic ointment 0.3% - 3.0
9.	Sulfasalazine	Tablet 0.5
10.	Phthalylsulfathiazole	Tablet 0.05
11.	Nitrofurantoin	Tablet 0.05; 0.1
12.	Sulfacetamide	Eye drops 20% - 10 ml
13.	Nitrofurazone	Tablets 0.02 Ointment 0.2% - 25.0 Sol. 0.02% - 400ml in bottles (local)
14.	Silver nitrate	Sol. 10% - 10ml in bottles (local) Ointment 1% - 30.0
15.	Zinc sulfate	Tablets and dragees 0.01; 0.2 Eye drops 0.25% - 10 ml
16.	Alcohol sol. of iodine	Sol. 5%- 10 and 25 ml in vials
17.	Hydrogen peroxide solution	Sol. 3% - 100 ml in vials (external)
18.	Potassium permanganate	Powder 3.0 _ Sol. 0.5% and 5% - 100 ml in the vials (local)
19.	Alcohol ethyl	Sol. 20% ; 33% ; 70%; 90% - 100ml in vials
20.	Boric acid	Powder 10.0 Sol. 0.5%; 1% - 20ml and 40ml in bottles (local) Ointment 5% - 15.0
21.	Brilliant green	Sol. alcoholic 1%; 2% - 15ml and 30ml in bottles
22.	Chlorhexidine	Sol. 0.05% - 100ml in bottles Vaginal suppositories 0.016
23.	Cetylpyridinium	Tablets 0.0012
24.	Hexamethylenetetramine	Tablet 0.25 ; 0.5 Sol. 40% - 5ml in amp. Sol. 40% - 50ml in vials
25.	Furazolidon	Tabl. 0,05

2) List the groups and drugs used in (for): antiseptic components of toothpastes, unpleasant odor from the oral cavity, disinfection of water to make it drinkable, antiseptics in poisoning with morphine alkaloids, treatment of oropharyngeal infections, antiseptics for washing cavities in surgery, antiseptics for reducing bacterial plaque, hands disinfection, operating field processing, disinfectants with

decolorizers, disinfection of instruments, antiseptics in the treatment of simultaneous bacterial and fungal infections, plantar hyperhidrosis, preservation of anatomical parts, antiseptics in methemoglobinemia, gargles of the oral cavity in dental manipulations, prophylaxis of blepharitis and blenorrhea, pneumocystis pneumonia (caused by *Pneumocystis carinii*), nonspecific ulcerative colitis, intestinal infections, pulmonary tuberculosis, atypical infections, infections caused by toxoplasma, synthetic chemotherapy in urinary tract infections, protozoan infections, gastric and duodenal ulcers, anaerobic infections, pseudomembranous colitis, staphylococcal and streptococcal infections with polyresistance, infections caused by *Ps. aeruginosa*.

G. Individual Work for Knowledge Consolidation

1) **Tests** (Guidelines for Laboratory Work in Pharmacology).

2) **Tables** (knowledge summary)

Table 1

Indications of antiseptic and disinfectant drugs

Indications	Medicines and their concentrations
Antiseptic hand treatment	
Processing field operator	
Processing mucous membranes, purulent wounds, combustion surfaces and trophic ulcers	
Conjunctivitis, keratitis, blepharitis	
Disinfection of medical and surgical instruments of care for the sick	
Disinfection of pathological removals	
Processing of the mouth and laryngeal mucosa in various infections	
Disinfection of water	

Table 2

Determine the groups of antiseptics A-C (aldehydes, alcohols, halogenated)

Characteristic	A	B	C
Mechanism of action	- Denaturation of proteins with the formation of albuminates	It exhibits oxidizing properties by influencing the thiol	Alkylation of proteins

		groups of enzymes and proteins	
Effects	- antiseptic -disinfectant - astringent - irritating - revulsive	-antiseptic and disinfectant - deodorant - bleach	- antiseptic and disinfectant - deodorant - astringent
Indications	- Operating field processing - Disinfection of instruments - Processing of hard dental tissues	-Disinfection of drinking water - Antisepsis of skin, wounds, vaginal mucosa - In dentistry	- Processing of hands - Plantar hyperhidrosis - For the preservation of anatomical parts
Side effects	- Irritating effect on the mucous membrane - Local erythema	- Irritating effect on the mucous membrane High concentrations: acidosis, acute pulmonary edema, collapse, death.	-Local irritation -Alergic reactions

Table 3

Characteristic comparison of derivatives nitrofuran

Drugs	Route of administration	Indications
Nitrofurantoin		
Furazolidone		
Furazolidone		
Furazidone		

H. Interactive activity

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

Case 1

A patient came to the dentist with oral health problems. The doctor, after examining and performing dental procedures for the prevention of infections, reducing the formation of dental tartar, prescribed an antiseptic medicine for gargling the oral cavity. After use, the patient noticed taste disturbances, xerostomia, burning sensations of the tongue.

Determine the prescribed antiseptic?

Explain the mechanism of action, effects and indications of the prescribed preparation.

Case 2

The patient with pneumonia of mild evolution in ambulatory conditions was prescribed an antimicrobial drug with bacteriostatic action. After 7 days of treatment, the condition improved, but in a short time the patient complained of pain in the lumbar region and dysregulation of urination. During the urine examination, crystalluria, cylindruria, albuminuria, hematuria were determined.

What medicine was the cause of the complications?

What will be their preventive measures?

ANTIBIOTICS

A. Actuality. Antibiotics have a major impact on human health, through their ability to prevent, treat and prevent the transmission of infectious diseases. The rational use of antibiotics requires deep knowledge regarding the peculiarities of the spectrum and mechanism of action, indications, adverse reactions and use. Inadequate administration of antibiotics has determined the development of microbial resistance, and negative impact of antibiotic resistance on human health is huge and difficult to estimate, constituting a pressing problem at the global level.

B. The purpose of the training is: familiarizing students with the principles of classification, spectrum and mechanism of action, indications and side effects of antibiotics.

C. Learning objectives:

1) The student **must know:** classification, spectrum and mechanism of action, indications, contraindications, adverse effects, pharmacokinetics of antibiotics.

2) The student **must be able to:** prescribe antibiotics in medicinal forms existing, select antibiotics in diseases and pathological conditions.

D. Knowledge of previous and related disciplines necessary for interdisciplinary integration.

Microbiology. Microbial antagonism. Concepts of specific and nonspecific antagonism. Antimicrobial chemotherapy. Mechanisms of bacterial resistance to antibiotics. Pathogenicity and virulence of microorganisms. Bacterial pathogenicity factors. Bacterial enzymes.

E. Self-training questions:

1. Chemotherapy. Basic principles. Antibiotic requirements.
2. Classification of antibiotics according to chemical structure, mechanism of action, spectrum of action, type of antibacterial action.
3. Penicillins: classification, spectrum and mechanism of action, indications, adverse reactions, pharmacokinetics .
4. Cephalosporins: classification, spectrum and mechanism of action, indications, adverse reactions, pharmacokinetics .
5. Carbapenems and monobactams: spectrum and mechanism of action, indications, adverse reactions, pharmacokinetics .
6. Beta-lactam combined antibiotics: spectrum and mechanism of action, indications, adverse reactions.

7. Macrolides: classification, spectrum and mechanism of action, indications, adverse reactions, pharmacokinetics .
8. Lincosamides: spectrum and mechanism of action, indications, adverse reactions, pharmacokinetics .
9. Aminoglycosides: classification, spectrum and mechanism of action, indications, adverse reactions, pharmacokinetics .
10. Tetracyclines: classification, spectrum and mechanism of action, indications, side effects, pharmacokinetics .
11. Amphenicol derivatives: spectrum and mechanism of action, indications, adverse reactions, pharmacokinetics .
12. Glycopeptides: spectrum and mechanism of action, indications, , side effects pharmacokinetics .
13. Polymyxins: spectrum and mechanism of action, indications, side effects, pharmacokinetics
14. Ansamycins: spectrum and mechanism of action, indications, adverse reactions .
15. Antibiotics from miscellaneous groups: spectrum and mechanism of action, directions, adverse reactions.
16. Antistaphylococcal antibiotics. Characteristic.
17. Antibiotics used in the infections caused of bacilli gram negatives.
18. Antibiotics used in diseases caused by gram-negative anaerobic bacteria (bacteroides fragile etc.).
19. Bacterian resistance to antibiotics: the forms of resistance, biochemical and genetic mechanisms of appearance, ways of combating.
20. Principles of antibiotic combination. Antagonism and synergism. Basic indications for combining antibiotics.

F. Independent work (is done in written form while preparing for the lesson)

1) Medical prescription exercises

To prescribe the following drugs in all medicinal forms: 1. Sodium benzylpenicillin. 2. Benzathine benzylpenicillin. 3. Ampicillin. 4. Amoxicillin. 5. Azlocillin. 6. Cefuroxime. 7. Cefotaxime. 8. Cefixime. 9. Cefepime. 10. Meropenem. 11. Augmentin. 12. Lincomycin. 13. Clindamycin. 14. Clarithromycin. 15. Azithromycin. 16. Gentamicin. 17. Amikacin. 18. Polymyxin-M sulfate. 19. Doxycycline. 20. Chloramphenicol. 21. Vancomycin. 22. Rifampicin. 23. Tetracycline. 24. Fusidine. 25. Ceftriaxone.

No.	<i>The name of drugs</i>	<i>Form of delivery, dosage</i>
1	Amikacin	Lyophilized powder 0.1; 0.5 in vials Sol. 25% - 2ml in amp. Gel 5% - 30.0
2	Amoxicillin	Tablets / Capsules 0.25; 0.5 Powder / Granules for suspension 5.1 (0.25/5ml) in vials
3	Ampicillin	Tablet / Capsules - 0.25 Lyophilized powder 0.5; 1.0; 2.0 in vials
4	Augmentin (Amoxicillin + Acid clavulanic)	Tablet 0.625; 1.0 Powder for suspension 23.0 (0.4 +0.057/5ml) in vials
5	Azithromycin	Tablet / Capsules 0.25; 0.5 Powder for suspension 16.5 (0.1/5ml) in vials

6	Azlocillin	Lyophilized powder 0.5; 1.0 in vials
7	Benzathine benzylpenicillin	Lyophilized powder 600000UA; 1200000UA in vials
8	Sodium benzylpenicillin	Lyophilized powder 500000UA; 1000000UA in vials
9	Cefepime	Lyophilized powder 0.5;1.0 in vials
10	Cefixime	Tablet / Capsules - 0.4 Powder for suspension 32.0 (0.1 /5ml) in vials
11	Cefotaxime	Lyophilized powder. 0.5; 1.0 in vials
12	Cefuroxime	Lyophilized powder 0.75; 1.5 in vials
13	Cefuroxime axetil	Tablet / Capsules - 0.25; 0.5 Powder/ granules for suspension (0.125/5ml) in vials
14	Clarithromycin	Tablet / Capsules - 0.25; 0.5 Lyophilized powder 0.5 in vials Suspension 60ml (0.125/5ml) in vials
15	Clindamycin	Capsules 0.15; 0.3 Sol.15% - 2 ml in amp. Vaginal cream 2% - 20.0 Gel 1% - 30.0
16	Chloramphenicol	Tablet / Capsules - 0.25; 0.5 Eye drops 0.25% - 10ml in bottles Liniment 10% - 25.0
17	Doxycycline	Tablet / Capsules - 0.1; 0.2 Lyophilized powder 0.1; 0.2 in amp. / vials
18	Ceftriaxone	Powder in vials 0.5 and 1.0
19	Fusidine	Tablet 0.125; 0.25 Lyophilized powder 0.25; 0.5 in vials
20	Gentamicin	Sol. 4% - 1ml in amp. Lyophilized powder 0.08 in bottles Ophthalmic solution 0.3% - 5ml Ointment / Cream 0.1% - 30.0
21	Lincomycin	Capsules 0.25; 0.5 Sol. 30% - 1 ml in amp. Ointment 2% - 30, 0
22	Meropenem	Lyophilized powder 0.5; 1.0 in vials
2. 3	Polymyxin- M sulfate	Tablet - 500000UA Ointment 30.0 (20 000 AU/g)
24	Rifampicin	Capsules 0.15; 0.3 Lyophilized powder 0.15; 0.6 in vials
25	Tetracycline	Tablet / Capsules 0.1; 0.25 Ophthalmic ointment 1% - 3.0 Ointment 3% - 30.0
26	Vancomycin	Lyophilized powder 0.5; 1.0 in vials Capsules 0.125; 0.25

2) List the groups and drugs used in (for): prophylaxis of rheumatism, pneumonia, gas gangrene, anthrax, tetanus, syphilis, meningitis caused by H. influenzae, infections caused by Ps. aeruginosa, infections caused by Bac. fragilis, proteus infections, benzylpenicillin -resistant staphylococcal infections, methicillin- resistant staphylococcal infections, salmonellosis, pseudomembranous colitis, exanthematic typhus, typhoid fever, bacterial meningitis, tuberculosis, urinary infections,

enterococcal infections, intra-abdominal infections, community-acquired pneumonia, gastric ulcer and duodenal, infections due to neutropenia and immunodeficiency, perioperative prophylaxis in surgery, bone and joint infections, toxoplasmosis, intestinal decontamination in surgical interventions, atypical infections (Chlamydia , Legionella), dangerous infections (brucellosis, tularemia, plague), cholera.

G. Individual Work for Knowledge Consolidation

1) **Tests** (Guidelines for Laboratory Work in Pharmacology).

2) **Tables** (knowledge summary)

Table 1

Comparative characteristics of penicillin group drugs

Drugs	The way of administration	Acid-resistance (+/-)	Spectrum of action (broad / narrow)	Resistance to penicillinases (+/-)	Activity against pseudomonas aeruginosa (+/-)
Sodium benzylpenicillin					
Phenoxymethylpenicillin					
Oxacillin					
Ampicillin					
Ampiox					
Augmentin					

Table 2

Characteristics of drugs from the cephalosporin group

Drugs	Generation	Spectrum of action	Resistance to beta-lactamases of gram "+" microorganisms	Resistance to beta-lactamases of gram "-" microorganisms	Activity towards Pseudomonas aeruginosa
Cefazolin					
Cefuroxime					

Cefixime					
Cefepime					
Cefotaxime					
Ceftazidime					

Table 3

Select the antibiotics of choice and reserve in the treatment of infectious diseases

Infectious diseases	The drugs of choice	Reserve drugs
Pest		
Cholera		
Bacterial dysentery		
Abdominal typhus		
Meningitis		
Diphtheria		
Tetanus		
Syphilis		
Chlamydia		
Septicemia with <i>Pseudomonas aeruginosa</i>		

H. Interactive activity

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

Case 1

Patient with typhoid fever used an antibiotic. Clinical recovery occurred, but on the 10th day angina with high fever, eruptions on the mucous membranes of the lips and nasal passages began. The hematological examination revealed leukopenia and agranulocytosis.

What medicine did the patient use?

What was the origin of the complications that appeared during the treatment?

Case 2

A patient with a urinary tract infection caused by gram-negative bacilli has been prescribed an antibiotic. The patient's condition improved, but following the treatment, hypoacusis and dysregulation of renal functions developed.

What antibiotic could have caused these complications?

ANTISPIROCHETAL DRUGS

A. Actuality. Diseases caused by spirochetes, leptospire, and borreliae are of epidemiological importance, including sexually transmitted infections (syphilis) and less frequently encountered pathologies that require in-depth study of drugs with specific activity.

B. The purpose of training: is to familiarize students with the pharmacology of antispirechetal drugs necessary for the prophylaxis and treatment of diseases caused by these pathogenic agents.

C. Learning Objectives

- The student must know:** the classification, spectrum and mechanism of action, indications, adverse reactions, and pharmacokinetic properties of antispirechetal drugs.
- The student must be able to:** prescribe essential antispirechetal drugs and select medications according to the causative pathogens.

D. Knowledge of previous and related disciplines necessary for interdisciplinary integration.

Microbiology. Microbiology and laboratory diagnosis of spirochetal infections.

E. Self-training questions:

- Classification of antispirechetal drugs.
- Drugs used in the treatment of syphilis: classification, mechanism of action, indications, adverse reactions.
- Drugs used in the treatment of leptospirosis and relapsing fever: mechanism of action, indications, adverse reactions.

F. Independent work (is done in written form while preparing for the lesson)

1) Medical prescription exercises

To prescribe the following drugs in all medicinal forms: 1. Sodium benzylpenicillin 2. Benzathine benzylpenicillin 3. Erythromycin 4. Doxycycline 5. Cefazolin

<i>Nr.</i>	<i>Drug's name</i>	<i>Delivery forms, dosage</i>
1	Sodium benzylpenicillin	Lyoph. Powder 500000 UA; 1000000 UA in vials
2	Benzathine benzylpenicillin	Lyoph. powder 1200000 UA; 2400000 UA in vials
3	Eritromicine	Tabl. 0,25; 0,5 Rectal sup. 0,05; 0,1 Susp. 100 ml in vials (internal use) Sol. 2% - 100 ml in vials (internal use) Ointment 30,0 (10 000 UA/1,0)
4	Doxycycline	Tabl. / Capsules 0,1; 0,2 Lyoph. Powder 0,1; 0,2 in vials Sol. 2% - 5ml in vials
5	Cefazolin	Lyoph. powder 0,5; 1,0 in vials

2) List the groups and drugs used in (for): treatment of syphilis, prophylaxis of syphilis relapse, treatment of leptospirosis, treatment of relapsing fever.

G. Individual Work for Knowledge Consolidation

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

H. Interactive activity

- Experimental and virtual didactic film** (elaboration of minutes, conclusions)
- Clinical cases** (Guidelines for Laboratory Work in Pharmacology).
- Virtual situations** (Guidelines for Laboratory Work in Pharmacology).

4. **Solve the case:**
A patient being treated for syphilis was administered a drug with degenerative bactericidal action. On the second day after administration, the patient's condition worsened: fever increased, symptoms of intoxication intensified, and the characteristic syphilitic skin rashes became more pronounced.
What drug was used and what is its mechanism of action?
What is the cause of the observed reactions?

ANTIVIRAL DRUGS

A. Actuality. Viruses are pathogenic agents that cause an increasing range of diseases with pandemic potential. The particularities of viral infection progression and frequent mutations necessitate intensive research and development of antiviral drugs, including the urgent creation of new preparations against emerging viruses with extremely rapid pathogenicity and infectivity. The incidence and rapid development of resistance require continuous improvement of the antiviral drug arsenal.

B. The purpose of the training is to familiarize students with the pharmacology of antiviral drugs, necessary for the prophylaxis and treatment of viral diseases.

C. Learning objectives

- The student must know:** classification, spectrum and mechanism of action, indications, adverse reactions, and pharmacokinetic properties of antiviral drugs.
- The student must be able to:** prescribe essential antiviral drugs and select medications according to the causative pathogens.

D. Knowledge of previous and related disciplines necessary for interdisciplinary integration.
Microbiology. Viruses. Taxonomy and nomenclature.

E. Self-training questions

- Antiviral drugs: classification according to their effect on virus type.
- Antiviral drugs active against orthomyxoviruses (influenza virus): classification, mechanisms of action, indications, adverse reactions.
- Antiviral drugs active against herpes viruses: classification, mechanisms of action, indications, adverse reactions.
- Antiviral drugs active against human immunodeficiency virus (antiretrovirals): classification, mechanisms of action, indications, adverse reactions.
- Antiviral drugs used in the treatment of viral hepatitis B: classification, mechanisms of action, indications, adverse reactions.
- Antiviral drugs used in the treatment of viral hepatitis C: classification, mechanisms of action, indications, adverse reactions.
- Interferon preparations: spectrum and mechanism of action, indications, adverse reactions; recombinant interferon drugs.
- Antiviral drugs used in cytomegalovirus infections: spectrum and mechanism of action, indications.
- Antiviral drugs active against papillomavirus infections: spectrum and mechanism of action, indications.
- Drugs used in coronavirus infections (SARS-CoV-2): classification, mechanisms of action, specific antiviral effects, indications, adverse reactions.

F. Independent work (is done in written form while preparing for the lesson)

1) Medical prescription exercises

To prescribe the following drugs in all medicinal forms: 1. Rimantadine 2. Oseltamivir 3. Acyclovir 4. Vidarabine 5. Zidovudine 6. Nevirapine 7. Interferon alfa 8. Ribavirin 9. Foscarnet 10. Lamivudine 11. Remdesivir 12. Molnupiravir

Nr.	Drug's name	Delivery forms, dosage
1	Rimantadine	Tabl. 0,05; 0,1 Syrop 0,2% -100ml
2	Oseltamivir	Capsules 0,045; 0,075
3	Aciclovir	Tabl. / Capsules 0,2; 0,4 Susp. 4% - 100ml in vials(internaly) Lyoph. powder 0,25; 0,5 in vials (i/v) Ointment / Cream 5% - 10,0 Ophtalmic ointment 3% - 5,0
4	Vidarabine	Ophtalmic ointment 3% - 5,0; Gel 10% - 10,0
5	Zidovudine	Capsule 0,25; Syrop 1% - 200ml Sol. 1%; 2% - 20ml in amp.
6	Nevirapine	Tabl. / Capsule 0,2 Susp. 240ml in vials (internal use)
7	Interferon alfa	Sol. 1ml (5000000UI) in amp. (i/m; s/c) Lyoph. powder 1000 UI in amp intranasal;
8	Ribavirine	Capsule 0,2
9	Foscarnet	Sol. 2,4% - 250ml; 500 ml in vials (i/v); Ointment / Cream 3% - 5,0; 10,0
10	Lamivudine	Tabl. 0,1
11	Remdesivir	Lyoph. powder 0,1 in vial
12	Molnupiravir	Capsule 0,2

2) List the groups and drugs used in (for): prophylaxis and treatment of influenza A, prophylaxis and treatment of influenza A and B, herpes virus infections, cytomegalovirus infections, human immunodeficiency virus (HIV) infections, papillomavirus infections, viral hepatitis B, viral hepatitis, coronavirus (SARS-CoV-2) infection.

G. Individual Work for Knowledge Consolidation

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

2) Tables (knowledge summary)

Table 1

Mechanisms of action of certain antiviral drugs

Drug	Mechanism of action
Rimantadine	
Oseltamivir	
Aciclovir	
Foscarnet	
Maribavir	
Zidovudine	
Nelfinavir	
Interferon alfa	
Ribavirine	

Sofosbuvir	
Remdesivir	
Molnupiravir	

Table 2

Spectrum of action of certain antiviral drugs

Virus	Rimantadine	Ribavirine	Aciclovir	Ganciclovir	Zidovudine
Influenza type A					
Influenza type B					
Measles					
Rubella					
Herpes					
Hepatitis B					
HIV/AIDS					
Smallpox					

H. Interactive activity

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

On the 3rd day of the illness, for the treatment of influenza, an antiviral drug was prescribed for a child. Method of administration: 3–5 drops in each nostril every 2–3 hours, at least 5 times a day. After 3 days, the child's condition improved only slightly.

Which drug was prescribed?

What is the reason for its limited efficacy?

ANTIFUNGAL MEDICATIONS

A. Actuality. Pathogenic and conditionally pathogenic fungi cause local and systemic mycoses, the treatment of which is difficult. The effectiveness of antifungal medications depends on their spectrum of action, pharmacokinetic characteristics, and the localization of the fungi.

B. The purpose of the training is to familiarize students with the pharmacological properties of antifungal medications and to develop skills and understanding for selecting drugs according to the form and localization of fungal infections.

C. Learning objectives

- a) **The student must know:** the classification, spectrum and mechanism of action, indications and adverse reactions, and pharmacokinetic characteristics of antifungal medications.
- b) **The student must be able to:** prescribe mandatory antifungal medications; indicate the appropriate drugs for various mycoses.

D. Knowledge of previous and related disciplines necessary for interdisciplinary integration.

Microbiology. Microbiology and laboratory diagnosis of candidiasis and mycoses caused by filamentous fungi.

E. Self-training questions:

1. Antifungal medications: classification according to origin and route of administration, mechanisms of action.

2. Antifungal antibiotics: spectrum and mechanism of action, indications, adverse reactions.
3. Imidazole derivatives: spectrum and mechanism of action, indications, adverse reactions.
4. Triazole derivatives: spectrum and mechanism of action, indications, adverse reactions.
5. Echinocandins: spectrum and mechanism of action, indications, adverse reactions.
6. Antifungal medications used in dermatomycoses: spectrum and mechanism of action, indications, adverse reactions.

F. Independent work (is done in written form while preparing for the lesson)

1) Medical prescription exercises

To prescribe the following drugs in all medicinal forms: 1. Amphotericin B. 2. Caspofungin. 3. Griseofulvin. 4. Clotrimazole. 5. Miconazole. 6. Terbinafine. 7. Nystatin. 8. Fluconazole

<i>Nr.</i>	<i>Drug's name</i>	<i>Delivery forms, dosages</i>
1	Amphotericin B	Lyoph.powder 50 000 UA in vials (i/v) Ointment 15,0
2	Nystatin	Tabl. 250 000; 500 000 UA Vaginal / rectal supp. - 250 000 UA Ointment 10,0; 30,0 (100 000 UA/1,0)
3	Griseofulvin	Tabl. 0,125
4	Clotrimazole	Vaginal Tabl. 0,2; 0,5 Ointment / Cream 1% - 20,0 Gel / Vaginal Cream 2% - 20,0 Aerosol 1% - 20ml (external use)
5	Miconazole	Cream / Gel 2% - 30,0 Capsules 0,2; 0,4 Vaginal supp. 0,2; 0,4
6	Terbinafine	Tabl. 0,25 Aerosol 1% - 30 ml in vials (external use) Cream 1% - 10,0; 30,0;
7	Caspofungin	Lyoph. powder 0,05 in vials (i/v)
8	Fluconazol	Tabl. / Capsule 0,15 Syrop 0,5% - 50ml Susp. 1% - 50ml (internal use) Sol. 0,2% - 50ml; 200ml in vials (i/v)

2) List the groups and drugs used in (for): systemic mycoses, fungal meningitis, candidiasis, dermatomycoses, onychomycosis, hair candidiasis.

G. Individual Work for Knowledge Consolidation

- 1) **Tests** (Guidelines for Laboratory Work in Pharmacology).
- 2) **Tables** (knowledge summary)

Table 1

Spectrum of action of antimicrobial drugs

Drugs	Candidomycoses	Dermatomycoses	Systemic mycoses
Amphotericin B			
Nystatin			
Griseofulvin			
Ketoconazole			
Clotrimazole			
Itraconazole			
Terbinafine			
Fluconazol			

Table 2

Identify the medications according to their mechanism of action.

Mechanism of action	Drugs
Irreversible binding to ergosterol and other specific sterols in the cytoplasmic membrane of fungal cells, leading to disruption of membrane permeability and loss of ions and macromolecules with toxic consequences.	a. b. c.
Inhibition of ergosterol synthesis, an essential component of the fungal cytoplasmic membrane, by inhibiting specific enzymes (14- α -sterol demethylase, squalene epoxidase, etc.).	a. b. c.
Inhibition of nucleic acid synthesis by blocking specific enzymes and microtubule functions, leading to disruption of protein synthesis.	a. b.
Inhibition of D-glucan synthesis, an essential component of the fungal cell wall.	a. b.
Disruption of cytoplasmic membrane permeability to ions, amino acids, and proteins essential for fungal metabolism.	a.

H. Interactive activity

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

A patient with systemic fungal infections was prescribed an antifungal medication. During treatment, the patient developed fever, chills, dyspeptic disorders (nausea, vomiting, diarrhea, anorexia), muscle and joint pain. On examination, leukopenia, thrombocytopenia, anemia, elevated liver enzymes, urea, and creatinine were observed.

Which antifungal medication was prescribed to the patient?

What are the adverse reactions, and what preventive measures should be taken?

Which antifungal drugs with fewer adverse reactions could have been used?

ANTITUBERCULOSIS AND ANTILEPROSY 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:

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

b) 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. Knowledge of previous and related disciplines necessary 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 and according 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 (is done in written form while preparing for the lesson)

1) Medical prescription exercises

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.

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 amp.
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

- 2) **List the groups and drugs used in (for):** sensitive pulmonary tuberculosis, antibiotics in tuberculosis, synthetic chemotherapeutic drugs in tuberculosis, synthetic drugs in tuberculosis, tuberculosis prophylaxis, multi-drug resistant tuberculosis, first-line drugs in leprosy.

G. Individual Work for Knowledge Consolidation

- 1) **Tests** (Guidelines for Laboratory Work in Pharmacology).
- 2) **Tables** (knowledge summary)

Table 1

Determine the antituberculosis drugs						
Drugs	Way of administration	Mechanism of action	Half-life	Dyspeptic disorders	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	-	-	-

H. Interactive activity

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

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:

a) 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.

b) 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. Knowledge of previous and related disciplines necessary for interdisciplinary integration.

Microbiology. Parasitism. The specifics of the parasite's habitat. Classification. Types of protozoa. Characteristics. Class Sarcodina.

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. Drugs 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 (is done in written form while preparing for the lesson)

1) Medical prescription exercises

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.

No.	The name of the drugs	Forms of delivery
1	Chloroquine	Tablets 0.25 Sol. 0.5% - 5ml in amp.
2	Co-trimoxazole Sulfamethoxazole:Trimethoprim = 5:1	Tablets 0.24; 0.48 Suspension 80ml (0.24/5ml) Sol. 5 ml in amp.
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 amp. 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 amp.

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

G. Individual Work for Knowledge Consolidation

1) **Tests** (Guidelines for Laboratory Work in Pharmacology).

2) **Tables** (knowledge summary)

Table 1

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

Table 2

Indications of antimalarial drugs

Indications	Chloroquine	Quinine	Primaquine	Pyrimethamine
Access of 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	Depresses the normal intestinal flora	
Metronidazole				
Emetine				
Chiniophone				
Chloroquine				
Tetracycline				

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

H. Interactive activity

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

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 is determined.

What medication was prescribed to the patient?

What was the cause of the mental disorders?

ANTHELMINTIC 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:

a) 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.

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

D. Knowledge of previous and related disciplines necessary for interdisciplinary integration.

Microbiology. Concept of helminths. Types of helminths. Flatworms. Trematodes: liver fluke (*Fasciola hepatica*), cat fluke (*Opisthorchis felinus*), lanceolate fluke (*Dicrocoelium lanceolatum*), lung fluke (*Paragonimus*). Class Cestoda: beef tapeworm (*Taenia saginata*), pork tapeworm (*Taenia solium*), dwarf tapeworm (*Hymenolepis nana*). Life cycle. Roundworms. Ascarids, life 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 cestodosis: 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 (is done in written form while preparing for the lesson)

1) Medical prescription exercises

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.

<i>N o.</i>	<i>The name of the drugs</i>	<i>Forms of delivery</i>
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

2) List the groups and drugs used in (for): intestinal nematodes, intestinal cestodes, ascariasis, enterobiosis, tissue nematodes, tissue cestodes, tissue trematodes.

G. Individual Work for Knowledge Consolidation

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

2) Tables (knowledge summary)

Indicate the drugs according to the type of helminths

The type of helminthiasis	Types of helminths (causative agent)	Drugs
Intestinal: I. <u>Nematodes:</u> Ascariasis Trichuriasis Hookworm disease Enterobiosis Strongyloidosis II. <u>Cestodes:</u> Diphyllbothriasis Botryocephaphosis Teniosis Teniarynchosis Extraintestinal: I. <u>Nematodes:</u> Filariasis Trichinosis II. <u>Trematodes:</u> Fascioliasis Opisthorchosis Schistosomiasis	Nematodes: <i>Ascaris lumbricoides</i> <i>Trichocephalus trichiurus</i> <i>Strongyloides stercoralis</i> <i>Enterobius vermicularis</i> <i>Strongyloides stercoralis</i> Cestodes: <i>Diphyllobothrium latum</i> <i>Bothriocephalus acheilognathi</i> <i>Taenia solium</i> <i>Taeniarhynchus saginatus</i> Nematodes: <i>Wuchereria bancrofti</i> <i>Trichinella spiralis</i> Trematodes <i>Fasciola hepatica</i> <i>Opisthorchis felinus</i> <i>Schistosoma haematobium</i>	

Table 2

Mechanism of action of antihelminthic drugs.

The mechanism of action (on helminths)	Mebendazole	Levamisole	Niclosamide	Praziquantel	Albendazole	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						

H. Interactive activity

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

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.

Summary on the topic:

ANTIMICROBIAL, ANTIPARASITIC AND ANTIHELMINTIC DRUGS

A. Self-training questions

1. Antiseptics and disinfectants: definition, classification by chemical structure, mechanisms of action.
2. Metal compounds: mechanisms of action, effects, indications, local action (astringent, irritant, and cauterizing).
3. Halogenated compounds: classification. Chlorine drugs: mechanism of action, effects, indications, adverse reactions. Iodine drugs: classification, mechanism of action, effects, indications, adverse reactions.
4. Oxidizing agents: mechanism of action, effects, indications, adverse reactions of hydrogen peroxide and potassium permanganate.
5. Detergents: classification. Anionic and cationic detergents: mechanism of action, effects, indications.
6. Aldehydes: mechanism of action, effects, indications.
7. Biguanides: mechanism of action, effects, indications.
8. Alcohols: mechanism of action, effects, indications.
9. Classification of antibiotics by chemical structure, mechanism of action, spectrum of activity, type of antibacterial action.
10. Beta-lactam antibiotics. Classification. Penicillins: classification, spectrum and mechanism of action, indications, adverse reactions, pharmacokinetics.
11. Cephalosporins: classification, spectrum and mechanism of action, indications, adverse reactions, pharmacokinetics.
12. Carbapenems and monobactams: spectrum and mechanism of action, indications, adverse reactions, pharmacokinetics.
13. Macrolides: classification, spectrum and mechanism of action, indications, adverse reactions, pharmacokinetics.
14. Lincosamides: spectrum and mechanism of action, indications, adverse reactions, pharmacokinetics.
15. Aminoglycosides: classification, spectrum and mechanism of action, indications, adverse reactions, pharmacokinetics.
16. Tetracyclines: classification, spectrum and mechanism of action, indications, adverse reactions, pharmacokinetics.
17. Chloramphenicol derivatives: spectrum and mechanism of action, indications, adverse reactions, pharmacokinetics.
18. Glycopeptides: spectrum and mechanism of action, indications, dosing principles, adverse reactions, pharmacokinetics.
19. Polymyxins: spectrum and mechanism of action, indications, adverse reactions.
20. Bacterial resistance to antibiotics: forms of resistance, genetic and biochemical mechanisms, methods to combat resistance.
21. Principles of antibiotic combination therapy: antagonism and synergism, indications for combination.
22. Sulfonamides: classification, spectrum and mechanism of action, indications, adverse reactions, pharmacokinetics.
23. Combined sulfonamides: composition, spectrum and mechanism of action, indications, adverse reactions, pharmacokinetics.
24. Nitrofurans: classification, spectrum and mechanism of action, indications, adverse reactions.
25. Naphthyridine and quinolone derivatives: classification. Non-fluorinated quinolones: spectrum and mechanism of action, indications, pharmacokinetics.
26. Fluoroquinolones: classification, spectrum and mechanism of action, indications, adverse reactions, pharmacokinetics.

27. Nitroimidazole derivatives: classification, spectrum and mechanism of action, indications, adverse reactions, pharmacokinetics.
28. Oxazolidinones: spectrum and mechanism of action, indications, adverse reactions, pharmacokinetics.
29. 8-Oxyquinoline derivatives: classification, spectrum and mechanism of action, indications, adverse reactions.
30. Quinoxaline derivatives: spectrum and mechanism of action, indications, adverse reactions.
31. Classification of antitubercular drugs by origin, mechanism of action, and WHO guidelines. Mechanisms of action of antitubercular drugs.
32. Ansamycin antibiotics as antitubercular agents: spectrum and mechanism of action, indications, adverse reactions, pharmacokinetics.
33. Hydrazines as antitubercular agents: spectrum and mechanism of action, indications, adverse reactions, pharmacokinetics.
34. Antileprosy drugs: classification and mechanisms of action.
35. Classification of antiprotozoal drugs. Drugs used in malaria: classification by Plasmodium type, mechanisms of action, indications.
36. Drugs used in amoebiasis: classification, mechanisms of action, characteristics.
37. Drugs used in trichomoniasis: classification, mechanisms of action, characteristics.
38. Drugs used in giardiasis: classification, mechanisms of action, characteristics.
39. Drugs used in toxoplasmosis: classification, mechanisms of action, characteristics.
40. Drugs used in trypanosomiasis: classification, mechanisms of action, characteristics.
41. Drugs used in pneumocystosis: classification, mechanisms of action, characteristics.
42. Classification of antihelminthic drugs. Drugs used in intestinal nematode infections: mechanisms of action, indications, adverse reactions, pharmacokinetics.
43. Drugs used in intestinal cestode infections: mechanisms of action, indications, adverse reactions, pharmacokinetics.
44. Drugs used in extraintestinal helminth infections: mechanisms of action, indications, adverse reactions, pharmacokinetics.
45. Classification of antispirechete drugs. Drugs used in the treatment of syphilis, leptospirosis, and relapsing fever: mechanisms of action, indications, adverse reactions.
46. Classification of antiviral drugs by virus type (clinical use).
47. Antiviral drugs for influenza: classification, spectrum and mechanisms of action, indications, adverse reactions.
48. Anti-herpetic antiviral drugs: classification, spectrum and mechanisms of action, indications, adverse reactions.
49. Antiretroviral drugs: classification, spectrum and mechanisms of action, indications, adverse reactions.
50. Antiviral drugs used in hepatitis B: classification, spectrum and mechanisms of action, indications, adverse reactions.
51. Antiviral drugs used in hepatitis C: classification, spectrum and mechanisms of action, indications, adverse reactions.
52. Interferons: types, mechanism of action, pharmacological effects, indications, adverse reactions. Interferon inducers (interferonogens). Recombinant interferons.
53. Antiviral drugs used in SARS-CoV-2 coronavirus infections: mechanisms of action, indications, adverse reactions.
54. Classification of antifungal drugs by origin and route of administration. Mechanisms of action.
55. Antifungal antibiotics: spectrum and mechanism of action, indications, adverse reactions, pharmacokinetics.
56. Imidazole and triazole derivatives: spectrum and mechanism of action, indications, adverse reactions, pharmacokinetics.
57. Echinocandins as antifungals: spectrum and mechanism of action, indications, adverse reactions, pharmacokinetics.

F. Independent work (is done in written form while preparing for the lesson)

1) Medical prescription exercises. To prescribe the following drugs in all medicinal forms:

Nitrofurantoin. Silver nitrate. Zinc sulfate. Chloramine B. 5% Alcoholic iodine solution. Hydrogen peroxide solution. Potassium permanganate. Ethyl alcohol. Boric acid. Ammonia solution. Brilliant green. Chlorhexidine. Hexamethylenetetramine. Etacridine lactate. Sodium benzylpenicillin. Benzathine benzylpenicillin. Ampicillin. Azlocillin. Azithromycin. Lincomycin. Clindamycin. Gentamicin. Cefotaxime. Cefuroxime. Cefepime. Cefixime. Meropenem. Vancomycin. Clarithromycin. Amikacin. Fusidic acid. Augmentin (amoxicillin + clavulanic acid). Amoxicillin. Tetracycline. Doxycycline. Chloramphenicol. Polymyxin M sulfate. Rifampicin. Sulfaethidol. Sulfadimethoxine. Sulfalen. co-trimoxazole. Furazolidone. Nalidixic acid. Ofloxacin; Metronidazole; Nitroxoline; Linezolid; Ciprofloxacin; Sulfasalazine; Phthalylsulfathiazole; Nitrofurantoin; Mesalazine; Sulfacetamide; Rimantadine; Oseltamivir; Acyclovir; Foscarnet; Zidovudine; Interferon-alpha; Lamivudine; Ribavirin; Vidarabine; Amphotericin B; Nystatin; Clotrimazole; Griseofulvin; Miconazole; Fluconazole; Caspofungin; Terbinafine; Isoniazid; Ethambutol; Rifampicin; Streptomycin; Pyrazinamide; Levofloxacin; Dapsone; Clofazimine; Chloroquine; Metronidazole; Co-trimoxazole; Furazolidone; Pyrimethamine; Doxycycline; Pentamidine; Sodium stibogluconate (Solusurmine); Clarithromycin; Levamisole; Mebendazole; Praziquantel; Niclosamide; Pyrantel; Diethylcarbamazine; Ivermectin; Albendazole.

2) List the groups and drugs used in (for): rheumatism prophylaxis; pneumonia; gas gangrene; anthrax; tetanus; syphilis; meningitis caused by *H. influenzae*; infections caused by *Ps. aeruginosa*; infections caused by *Bact. fragilis*; infections caused by *Proteus*; staphylococcal infections resistant to benzylpenicillin; methicillin-resistant staphylococcal infections; salmonellosis; pseudomembranous colitis; exanthematous typhus; abdominal typhus; bacterial meningitis; tuberculosis; urinary tract infections; infections caused by enterococci; intra-abdominal infections; community-acquired pneumonia; gastric and duodenal ulcer; infections in neutropenia and immunodeficiency; perioperative prophylaxis in surgery; bone and joint infections; toxoplasmosis; intestinal decontamination in surgical interventions; atypical infections (*Chlamydia*, *Legionella*); dangerous infections (brucellosis, tularemia, plague); cholera; antiseptic components of toothpaste; halitosis; water purification; antiseptic in morphine poisoning; treatment of buccopharyngeal infections; antiseptics for cavity washing in surgery; antiseptics for plaque reduction; hand processing; surgical field preparation; disinfectants with bleaching effect; instrument disinfection; antiseptic in concurrent bacterial and fungal infections; plantar hyperhidrosis; preservation of anatomical specimens; antiseptics in methemoglobinemia; mouth gargles in dental manipulations; prophylaxis of blepharitis and blennorrhea; pneumocystic pneumonia (caused by *Pneumocystis jirovecii*); nonspecific ulcerative colitis; intestinal infections; pulmonary tuberculosis; atypical infections; infections caused by *Toxoplasma*; synthetic chemotherapeutics in urinary tract infections; protozoal infections; gastric and duodenal ulcer; anaerobic infections; pseudomembranous colitis; staphylococcal and streptococcal infections with multi-resistance; infections caused by *Ps. Aeruginosa*; prophylaxis and treatment of influenza A; prophylaxis and treatment of influenza A and B; herpes infections; cytomegalovirus infections; HIV infections; papillomavirus infections; hepatitis B; hepatitis C; SARS-CoV-2 coronavirus infection; systemic mycoses; dermatomycoses; fungal meningitis; onychomycosis; digestive candidiasis; vaginal candidiasis; skin candidiasis; treatment of syphilis; prophylaxis of syphilis relapses; treatment of leptospiral infection; relapsing typhus; drug-sensitive pulmonary tuberculosis; antibiotics in tuberculosis; synthetic chemotherapeutic agents in tuberculosis; synthetic preparations in tuberculosis; tuberculosis prophylaxis; multidrug-resistant tuberculosis; first-line preparations in leprosy; malarial coma; malaria attacks; treatment (eradication) of malaria; individual malaria prophylaxis; social malaria prophylaxis; prophylaxis of malaria relapses; amoebiasis of any localization; amoebiasis in intestinal lumen and wall; tissue amoebiasis; giardiasis; trichomoniasis; toxoplasmosis; balantidiasis;

leishmaniasis; trypanosomiasis; pneumocystosis; intestinal nematode infections; intestinal cestode infections; ascariasis; enterobiasis; extraintestinal helminth infections.