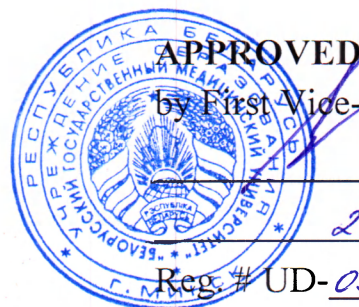


MINISTRY OF HEALTH OF THE REPUBLIC OF BELARUS  
EDUCATIONAL INSTITUTION  
BELARUSIAN STATE MEDICAL UNIVERSITY

Контрольный  
экземпляр



by First Vice-Rector, Professor

I.N.Moroz

27.06.2023

Reg. # UD-091-29/2324edu.

**PHARMACOLOGY**

**Curriculum of educational institution  
in the educational discipline for the specialty:**

**1-79 01 01 «General Medicine»**

Curriculum is based on the educational program «Pharmacology», approved 27.06.2023, registration # УД-091-29/2324/уч.; on the educational plan in the specialty 1-79 01 01 «General Medicine», approved 17.05.2023, registration # 7-07-0911-01/2324/mf.

**COMPILERS:**

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**RECOMMENDED FOR APPROVAL:**

by the Department of Pharmacology of the educational institution «Belarusian State Medical University»  
(protocol # 9 of May 19 2023);

by the Scientific and Methodological Council of the educational institution «Belarusian State Medical University»  
(protocol # 6 of 27.06.2023)

## EXPLANATORY NOTE

«Pharmacology» is an academic discipline of the module «Biomedical Module # 2», containing systematized scientific knowledge about medicines, their properties and applications.

The aim of the academic discipline «Pharmacology» is the formation of basic professional competencies, the basis of which is knowledge of modern medicines intended for the treatment and prevention of various diseases and correction of pathological conditions of the human body.

The objectives of the academic discipline «Pharmacology» are to develop students' scientific knowledge about:

principles, quantitative patterns and mechanisms of action of drugs at various levels of biological organization - molecular, cellular, organ, systemic;

pharmacokinetics of drugs in the human body: the processes of absorption, distribution, biotransformation, excretion, as well as the principles of rational dosing of drugs, including the choice of dosage form, routes of administration and dosage regimen;

the main pharmacological effects that ensure the therapeutic effect of drugs, indications and contraindications for their use, issues of drug interaction, the principles of their combined use;

the nature and manifestations of side (adverse) and toxic effects of drugs, as well as ways to minimize the negative consequences of their use;

rules for compiling a doctor's prescription and prescribing medicines in various dosage forms;

skills and abilities required for:

the use of medicines for the purpose of providing first aid in case of accidents, injuries, bleeding, poisoning and other conditions that threaten human life and health;

selection and correct prescription (dosing) of medicines in the treatment and prevention of diseases and pathological conditions of the human body.

The knowledge, skills and abilities acquired during the study of the academic discipline «Pharmacology» are necessary for the successful mastering of the following academic disciplines: «General Surgery», «Psychiatry and Narcology», «Internal Medicine» and modules: «Therapy Module 2», «Surgical Module 2», «Therapy Module 3», «Surgical Module 3», «Obstetric and Gynecology Module», «Pediatric Module».

Studying the educational discipline «Pharmacology» should ensure the formation of students' basic professional competencies.

BPC. Apply knowledge about the main characteristics of microorganisms causing human infectious diseases, the patterns of the immune system functioning, the mechanisms of disease development in case of microbiological assessment.

As a result of studying the academic discipline «Pharmacology», the student should:

**know:**

nomenclature of medicines;



legal, economic, organizational and deontological aspects of the use of medicines;

the basics of pharmacokinetics and pharmacodynamics of drugs, as well as the features of the use of drugs depending on the age of the patient;

indications for the prescription and clinical use of drugs from different pharmacotherapeutic groups;

toxic syndromes in case of drug overdose and poisoning, antidotes, principles of medical care for drug poisoning;

problems of drug allergies, principles of its prevention and treatment;

conditions and restrictions on the use of addictive drugs, methods of combating drug addiction;

rules for clinical testing and registration of new drugs;

rules of medical ethics and deontology;

**be able to:**

choose the method of drug administration and its dosage regimen based on the goals of pharmacotherapy, pharmacokinetic data of the drug, and the clinical characteristics of the patient;

analyze and critically evaluate scientific information on the effectiveness and tolerability of drugs;

work with reference manuals and electronic databases on medicines;

**master:**

skills in calculating an individual dosage regimen of drugs based on pharmacokinetic data and individual characteristics of the patient;

principles of correction of the dosage regimen in case of pathological changes in the functions of organs or systems responsible for the biotransformation and elimination of drugs or when using different drugs together;

the skills in writing and filling out a doctor's prescription when prescribing medicines in various dosage forms.

**Total number** of hours for the study of the discipline is 246 academic hours. Classroom hours according to the types of studies: lectures – 48 hours (including 16 hours of supervised student independent work), practical classes – 105 hours, student independent work (self-study) – 93 hours.

Intermediate assessment is carried out in accordance to the syllabus of the specialty in the form of a credit (5th semester) and examination (6th semester).

The form of higher education is full-time.



**ALLOCATION OF ACADEMIC TIME  
ACCORDING TO SEMESTERS OF STUDY**

Code, name of the specialty	semester	Number of academic hours						Form of intermediate assessment
		total	in-class	including			out-of-class self-studies	
				lectures (including supervised independent work)	supervised student independent work	practical classes		
1-79 01 01 «General Medicine»	5	126	81	24	8	57	45	credit
	6	120	72	24	8	48	48	examination
		<b>246</b>	<b>153</b>	<b>48</b>	<b>16</b>	<b>105</b>	<b>93</b>	

## THEMATIC PLAN

Section (topic) name	Number of class hours	
	lectures	practical
<b>1. Introduction to pharmacology and general prescription</b>	<b>2</b>	<b>6</b>
1.1. Subject of pharmacology. Terminology. Sources and stages of creation of drugs. Legislation of drugs	2	1
1.2. General prescription	-	8
<b>2. Pharmacokinetics of drugs</b>	<b>4</b>	<b>6</b>
2.1. Basics of pharmacokinetics	2	3
2.2. Principles of drug dosing	2	3
<b>3. Pharmacodynamics of drugs</b>	<b>2</b>	<b>6</b>
<b>4. Drugs affecting the peripheral nervous system</b>	<b>4</b>	<b>12</b>
4.1. Cholinergic drugs	2	6
4.2. Adrenergic drugs. Drugs affecting on afferent transmission of nerve impulses	2	6
<b>5. Drugs affecting the cardiovascular system and kidney function</b>	<b>10</b>	<b>18</b>
5.1. Diuretics and other drugs affecting the function of the urinary system	2	3
5.2. Antihypertensives and other agents that regulate systemic blood pressure	2	3
5.3. Antianginal agents. Means for correcting local blood flow disorders. Lipid-lowering drugs	2	6
5.4. Drugs for the treatment of heart failure. Cardiotonic drugs	2	3
5.5. Antiarrhythmic drugs	2	3
<b>6. Drugs affecting the blood system</b>	<b>2</b>	<b>6</b>
<b>7. Drugs affecting the central nervous system</b>	<b>8</b>	<b>12</b>
7.1. General anesthetics. Ethanol. Anticonvulsants and antiparkinsonian drugs	2	3
7.2. Analgesics	2	3
7.3. Anxiolytic and sedative-hypnogenic drugs. Antipsychotics	2	3
7.4. Antidepressants, normothimics, nootropics, psychostimulants, analeptics	2	3
<b>8. Agents regulating tissue metabolism</b>	<b>6</b>	<b>12</b>
8.1. Hormonal and antihormonal agents. Drugs that affect the tone and contractile activity of the myometrium.	2	6
8.2. Anti-inflammatory and anti-gout drugs	2	3
8.3. Antiallergic drugs. Immunomodulators. Vitamins and vitamin-like products	2	3
<b>9. Chemotherapeutic agents</b>	<b>8</b>	<b>15</b>
9.1. The concept of chemotherapy. Principles of action of antibacterial agents. Antiseptics and disinfectants	2	3



Section (topic) name	Number of class hours	
	lectures	practical
9.2. Antibiotics	2	3
9.3. Synthetic antimicrobial agents. Antimycobacterial agents	-	3
9.4. Antiviral and antimycotic agents	2	3
9.5. Antiprotozoal and antiparasitic agents	-	3
9.6. Anticancer drugs	2	-
<b>10. Drugs affecting respiratory function</b>	-	<b>3</b>
<b>11. Drugs affecting the functions of the digestive organs</b>	<b>2</b>	<b>3</b>
<b>12. Drug interactions. Antidotes and principles of medical care for acute drug poisoning</b>	-	<b>3</b>
<b>Total hours</b>	<b>48</b>	<b>105</b>

## CONTENT OF THE EDUCATIONAL MATERIAL

### 1. Introduction to pharmacology and general prescription

#### 1.1. Subject of pharmacology. Terminology. Sources and stages of creation of drugs. Legislation of drugs

The concept of treatment, main treatment factors and treatment methods. The essence of pharmacology as the science of controlling the vital processes of the body with the help of chemicals. The purpose and objectives of pharmacology. Historical stages in the development of pharmacology as a science, the contribution of domestic scientists to the development of pharmacology. Sections and areas of pharmacology. Clinical pharmacology. Pharmacy.

The concept of a medicinal substance, medicinal product, medicinal product, dosage form. Nomenclature of medicines. Sources of medicinal substances, stages of development and testing of medicinal products. Benefits and risks of using medications. Bioethical and deontological problems of pharmacology and pharmacotherapy. Declaration of Helsinki of the World Medical Association, ethical principles for medical research involving human subjects. Control of authorized institutions over the circulation of medicines. Legislation in the field of medicines.

#### 1.2. General prescription

*Rules of writing out prescriptions when prescribing medicines in various dosage forms*

State pharmacopoeia, its contents and purpose. International Pharmacopoeia. Pharmacy. Rules for storage and dispensing of medicines. Recipe and its structure. Rules for writing prescriptions. Features of prescribing narcotic, poisonous and potent drugs.

Solid dosage forms (powders, tablets, dragees, capsules, granules, etc.): their characteristics, advantages and disadvantages, prescribing rules.

Liquid dosage forms: general characteristics, dosage, prescribing rules. Solutions for external use and oral administration. Solvents. Official solutions. Suspensions. Liquid dosage forms obtained on the basis of herbal medicinal raw materials: galenic and neogalenic preparations; tinctures, infusions, decoctions,



mixtures, mucus; emulsions; extracts. Liniments. Potions.

General characteristics and requirements for dosage forms for injections. Rules for prescribing factory- and pharmacy-made injection forms.

Soft (semi-solid) dosage forms (ointments, pastes, gels, creams, suppositories, etc.): rules for manufacturing and prescribing.

Special dosage forms - therapeutic systems (oral, transdermal, parenteral); aerosols; dosage forms for children.

## **2. Pharmacokinetics of drugs**

### **2.1. Basics of pharmacokinetics**

Transfer of drugs in the body: absorption, distribution, metabolism, excretion; movement of drugs through barriers. Determinants of transfer. Water diffusion. Diffusion in lipids. Transfer of substances with variable ionization through membranes. Active transport of substances. The main factors influencing the transport of drugs in the body.

Ways of introducing drugs into the body, their purposes, advantages, disadvantages. Pre-systemic elimination of drugs. Distribution of drugs in the body: water spaces and cellular compartments; speed and uneven distribution of medicinal substances. Quantitative laws of absorption and elimination of drugs. Linear and nonlinear pharmacokinetics. Pharmacokinetic models (single-chamber, two-chamber).

Main pharmacokinetic parameters: bioavailability, volume of distribution, clearance, half-life, elimination constant; their essence, principles of definition and quantitative expression, dimension, relationship, significance for dosing of medicines.

#### *Biotransformation and excretion of drugs*

The need for biotransformation of drugs and its biological meaning, main focus, tissue localization. The influence of biotransformation on the activity of drugs. Phases of metabolic transformations of drugs. Microsomal systems of xenobiotic metabolism: molecular organization, induction and inhibition. Main types of biotransformation of drugs. Metabolism of drugs into toxic products. Clinical significance of the biotransformation of drugs (population dispersion and genetic polymorphism of xenobiotic metabolism, the influence of gender, age, body weight, environmental factors, smoking, alcohol on the biotransformation of drugs); metabolic drug interactions. Diseases affecting the biotransformation of drugs.

Clearance as the main determinant of pharmacokinetics. Renal clearance of drugs and its components: filtration, active secretion, reabsorption. Factors affecting renal clearance. Clearance of drugs by the liver – metabolic transformation and secretion into bile. Basic properties of substances secreted in bile. Factors modifying drug clearance.

### **2.2. Principles of drug dosing**

Drug dosing goals and variables: dose, types of doses, routes and intervals of administration. Introductory (loading) dose: therapeutic meaning, calculation of an individual loading dose according to pharmacokinetic parameters. Conditions and restrictions on the use of loading doses.

Maintenance doses: therapeutic meaning, calculation of maintenance doses to

ensure optimal dosing regimen.

Introduction of drugs into the bloodstream at a constant rate. Kinetics of drug concentration in the blood and its dependence on pharmacokinetic parameters, solution concentration and rate of administration. Stationary equilibrium concentration of a drug in the blood ( $C_{SS}$ ), time to reach it, calculation and control of  $C_{SS}$ .

Intermittent (discrete) dosing: fluctuations in the concentration of a drug in the blood, therapeutic and toxic concentration ranges. Calculation of  $C_{SS}$  of a medicinal substance and the limits of its fluctuations (minimum ( $C_{SS\ min}$ ) and maximum ( $C_{SS\ max}$ )) with discrete dosing of drugs, control of the concentration of the medicinal substance. Adequate interval for administering discrete doses.

*Correction of drug dosage regimens for various physiological and pathological conditions*

Individual characteristics of the distribution and metabolism of drugs. Diseases affecting the pharmacokinetics of drugs. A strategy of individual pharmacotherapy aimed at maintaining therapeutic concentrations of a drug in the blood. Adjustments for calculating individual volume of distribution values taking into account age, gender, body weight, overweight (obesity), fluid sequestration, dehydration.

Principles of correction of drug dosage regimens for liver and kidney diseases (general approaches). Correction of the dosage regimen under the control of the total clearance of the drug; preferred options. Correction of the dosage regimen under the control of residual renal function, in case of liver damage and other pathological conditions, drug interactions.

### **3. Pharmacodynamics of drugs**

The nature of the biological action of chemicals. The concept of receptors in pharmacology. Chemical and physicochemical determinants of the pharmacological activity of drugs, affinity and internal activity of drugs. Interaction of drugs with targets: receptor agonism (complete, partial, inverse), receptor antagonism (competitive, non-competitive), nonspecific mechanisms of action of drugs. Terms and concepts of quantitative pharmacology – effect, effectiveness, activity. Quantitative laws of action of drugs. The law of decreasing response of biological systems. General view of the dose-effect relationship in normal and lognormal coordinates.

Types of action of drugs. Pharmacodynamic action and placebo effect. Types of pharmacotherapy. Therapeutic range of drugs. Methods for assessing the effect of drugs (gradual, quantum), their essence and clinical applications. Variability and variation in the effects of drugs. Hyporeactivity, hyperreactivity, hypersensitivity, idiosyncrasy. Tolerance and its special cases (tachyphylaxis, mithridatism). Cumulation. Causes and consequences of variability in the effects of drugs. Drug addiction.

Types of doses: minimum, average and highest therapeutic doses, single, daily and course doses, introductory and maintenance doses, toxic doses. Drug safety assessment. Therapeutic index and standard safety margins.

Factors that provide therapeutic, side and toxic effects of drugs. Polytropism and pleiotropy of drugs, clinical significance. The influence of drugs on the fetus and the course of pregnancy, the concept of embryotoxic, teratogenic, fetotoxic effects.



Therapeutic strategy to combat the side and toxic effects of drugs.

Drug interactions, its types. Synergism of drugs, addition and potentiation of effects. Synergistic combinations of drugs as the basis of modern pharmacotherapy. Antagonism of drugs, its types and clinical significance.

#### **4. Drugs affecting the peripheral nervous system**

##### **4.1. Cholinergic drugs**

General structure diagram, neurotransmitters and receptors of the peripheral (somatic and autonomic) nervous system. Cholinergic signaling. The structure of cholinergic synapses and the mechanism of transmission of nerve impulses. The mechanism of acetylcholine release and its regulation. Molecular structure and heterogeneity of cholinergic receptors: muscarinic ( $M_1$  - $M_5$ ) and nicotinic ( $N_m$ ,  $N_n$ ) cholinergic receptors. Localization and effects of physiological and pharmacological stimulation.

*Cholinergic agonists (cholinomimetic agents).*

M-cholinomimetics (pilocarpine, bethanechol, cevimeline): effects on the eye, smooth muscles of internal organs, gland secretion, cardiovascular and central nervous systems; application, side effects.

N-cholinomimetics: nicotine, cytisine, varenicline. Effects of stimulation of N-cholinergic receptors of the sinocarotid zone, chromaffin cells of the adrenal medulla. Nicotinism. Nicotine replacement therapy of tobacco-use disorders.

M, N-cholinomimetics (acetylcholine chloride); pharmacological effects.

Anticholinesterase drugs. Reversible cholinesterase inhibitors: neostigmine, pyridostigmine, physostigmine, donepezil, rivastigmine. Irreversible cholinesterase inhibitors: organophosphorus compounds: ethylnitrophenylethylphosphonate (Armin), insecticides (malathion), chemical warfare agents. Pharmacological effects, side and toxic effects of anticholinesterase drugs; medical aid for poisoning: cholinesterase reactivators (pralidoxime), anticholinergic blockers (atropine). Acetylcholine release stimulants (itopride).

*Anticholinergic drugs.*

Agents that inhibit the release of acetylcholine (botulinum toxin A); application, side effects.

M-anticholinergics: atropine, hyoscine butyl bromide, ipratropium bromide, tiotropium bromide, tropicamide, darifenacin, oxybutynin, solifenacin. The effect of M-anticholinergic drugs on the eye, smooth muscles of internal organs, gland secretion, cardiovascular and central nervous systems. Comparative characteristics of M-anticholinergics, use, side effects. Help with poisoning with M-anticholinergic drugs.

Ganglion blockers ( $N_n$  -cholinergic blockers): hexamethonium benzosulfonate. Pharmacological effects, indications for use, side effects of ganglion blockers.

Drugs that block neuromuscular transmission ( $N_m$ -cholinergic blockers): mivacurium, cisatracurium, vecuronium, rocuronium, suxamethonium chloride. Classification, mechanisms of muscle relaxant action, application, side effects, pharmacological antagonists of  $N_m$ -cholinergic blockers.

Central anticholinergics (trihexyphenidyl, biperiden): pharmacological effects, application.



## 4.2. Adrenergic drugs. Drugs affecting on afferent transmission of nerve impulses

Adrenergic signaling. The structure of adrenergic synapses and the mechanism of transmission of nerve impulses. Regulation of the release of mediators, their elimination from the synapse and metabolism. Heterogeneity of adrenergic receptors ( $\alpha$  and  $\beta$ -adrenergic receptors): localization, effects of physiological and pharmacological stimulation.

### *Adrenergic agonists (adrenergic agonists)*

$\alpha$ -Adrenomimetics:  $\alpha_1$ -adrenergic agonists – phenylephrine;  $\alpha_2$ -adrenergic agonists – clonidine, methyldopa, tizanidine, brimonidine;  $\alpha_1, \alpha_2$ -adrenergic agonists (relatively selective  $\alpha_2$ -adrenergic agonists) – xylometazoline, naphazoline.

$\beta$ -Adrenergic agonists:  $\beta_1$ -adrenergic agonists – dobutamine;  $\beta_2$ -adrenergic agonists – salbutamol, salmeterol, fenoterol; hexoprenaline;  $\beta_3$ -adrenergic agonists – mirabegron;  $\beta_1, \beta_2, \beta_3$ -adrenergic agonists (non-selective) – isoprenaline.

$\alpha$ - and  $\beta$ -adrenergic agonists: epinephrine, norepinephrine, dopamine. Pharmacological effects of adrenergic agonists of various groups depending on the dose and rate of administration, application, side and toxic effects.

### *Adrenergic blocking agents*

$\alpha$ -Adrenergic blockers:  $\alpha_1$ -adrenergic blockers – doxazosin, terazosin, tamsulosin;  $\alpha_2$ -blockers – yohimbine;  $\alpha_1, \alpha_2$ -adrenergic blockers (non-selective) – phenoxybenzamine, phentolamine, nicergoline.

$\beta$ -Adrenergic blockers:  $\beta_1, \beta_2$ -adrenergic blockers (non-selective) – propranolol, sotalol, pindolol, timolol;  $\beta_1$ -blockers (cardioselective) – metoprolol, bisoprolol, betaxolol, acebutolol, atenolol, nebivolol.

$\alpha$ - and  $\beta$ -blockers: carvedilol, labetalol.

Pharmacodynamics and pharmacokinetics of adrenergic blockers of various groups, application, side and toxic effects. Criteria for choosing  $\beta$ -blockers: selectivity, internal sympathomimetic activity, additional vasodilating activity, duration of action, effect on lipid and carbohydrate metabolism.

### *Presynaptic agents*

Sympathomimetics (ephedrine) and sympatholytics (reserpine); pharmacological effects, application, side effects.

### *Drugs affecting afferent transmission of nerve impulses*

Local anesthetics: procaine, benzocaine, tetracaine, lidocaine, bupivacaine, articaine, ropivacaine. Classification, mechanism of action, application for different types of anesthesia (infiltration, conduction, superficial). Toxic effect of local anesthetics, ways to prevent it.

Astringents (tannin, zinc oxide), enveloping agents (mucus, sucralfate), adsorbing agents (activated carbon), irritants (menthol, ammonia solution) agents; principles of operation, application.

## 5. Drugs affecting the cardiovascular system and kidney function

### 5.1. Diuretics and other drugs affecting the function of the urinary system

#### *Diuretics*

Thiazide and thiazide-like: hydrochlorothiazide, chlorthalidone, indapamide; loop (furosemide, torasemide); potassium-sparing (triamterene, spironolactone,



eplerenone); osmotic (mannitol); carbonic anhydrase inhibitors (acetazolamide, brinzolamide); antidiuretic hormone antagonists (tolvaptan, conivaptan)

Mechanisms of diuretic action, speed of onset and duration of effect. The effect of diuretics on ion balance. Criteria for choosing diuretics, use, side effects.

*Other drugs affecting renal function:* drugs that increase renal blood flow and glomerular filtration (dopamine, fenoldopam, xanthines, cardiac glycosides); antidiuretic hormone agonists (desmopressin); uricosuric agents (sulfapyrazone); combination drugs and herbal remedies for the treatment of urolithiasis - principles of action and application.

## **5.2. Antihypertensives and other agents that regulate systemic blood pressure**

The main groups of antihypertensive drugs:

diuretics (hydrochlorothiazide, indapamide, furosemide, torsemide, spironolactone, eplerenone, triamterene);

inhibitors of the renin-angiotensin-aldosterone system (RAAS) (aliskiren, captopril, enalapril, lisinopril, losartan, candesartan);

$\beta$ -blockers (propranolol, metoprolol, atenolol, bisoprolol, nebivolol) and mixed  $\alpha$ - and  $\beta$ -blockers (labetalol, carvedilol);

calcium channel blockers (nifedipine and its prolonged forms, amlodipine, verapamil, diltiazem);

additional agents: central action (clonidine, methyldopa, moxonidine),  $\alpha_1$ -adrenergic blockers (doxazosin, urapidil), vasodilators (hydralazine, diazoxide, sodium nitroprusside, magnesium sulfate, bendazole), ganglion blockers (hexamethonium, mecamlamine), sympatholytics (reserpine).

Mechanisms of action, pharmacokinetics, side effects of antihypertensive drugs, principles of their combination. Principles of pharmacotherapy of arterial hypertension and criteria for the selection of antihypertensive drugs. Differences in pharmacotherapeutic approaches to the treatment of arterial hypertension and relief of hypertensive crises.

Drugs that increase systemic blood pressure (hypertensive): phenylephrine, midodrine. Mechanisms of action, methods and routes of administration, side effects.

## **5.3. Antianginal agents. Means for correcting local blood flow disorders. Lipid-lowering drugs**

*Antianginal agents:*

$\beta$ -adrenergic blockers: propranolol, atenolol, metoprolol, bisoprolol, nebivolol;

calcium channel blockers: diltiazem, verapamil, nifedipine and its prolonged forms, amlodipine;

organic nitrates and nitrate-like agents: nitroglycerin, isosorbide mononitrate, isosorbide dinitrate, molsidomine;

other antianginal agents: nicorandil, ranolazine, ivabradine, trimetazidine.

Mechanisms of action, pharmacokinetics, side effects of antianginal drugs. The phenomenon of «robbing» the myocardium. Withdrawal syndrome. Nitrate tolerance. Modern strategy for pharmacotherapy of coronary heart disease, comparative characteristics of antianginal drugs in terms of their effect on the course and prognosis of CHD, choice of drugs for the relief and prevention of angina attacks.



*Drugs for the treatment of pulmonary arterial hypertension:* endothelin receptor blockers (ambrisentan, macitentan), prostacyclin receptor agonists (selexipag), prostacyclin analogues (treprostenil), phosphodiesterase-5 inhibitors (sildenafil), guanylate cyclase stimulators (riociguat). Principles of action, routes of administration, therapeutic and side effects.

*Drugs used for chronic cerebrovascular accidents (cerebral vasodilators)* - cinnarizine, vinpocetine, nicergoline, nimodipine, Ginkgo biloba preparations (including in combinations). Principles of action, therapeutic and side effects.

*Drugs for the treatment of erectile dysfunction:* phosphodiesterase-5 inhibitors (sildenafil, tadalafil, avanafil); prostaglandin analogues (alprostadil). Mechanisms of action, routes of administration, conditions and limitations of use, side effects and dangerous drug interactions (nitrates).

*Agents that improve venous and lymphatic drainage* horse chestnut seed extract dry, troxerutin, diosmin (including in combinations).

*Lipid-lowering drugs:* statins (atorvastatin, rosuvastatin); inhibitors of microsomal triglyceride transport protein (lomitapide); fibrates (gemfibrozil); bile acid sequestrants (colestyramine); cholesterol absorption inhibitors (ezetimibe); nicotinic acid, enduracin; probakol. Mechanisms of action, clinical use, selection criteria, side effects.

#### **5.4. Drugs for the treatment of heart failure. Cardiotonic drugs**

The main drugs for the treatment of heart failure:

RAAS inhibitors (captopril, enalapril, lisinopril, losartan, valsartan, including the valsartan/sacubitril combination);

$\beta$ -adrenergic blockers (bisoprolol, nebivolol, carvedilol);

diuretics (hydrochlorothiazide, furosemide, torsemide, spironolactone, eplerenone);

vasodilators: isosorbide dinitrate, sodium nitroprusside, nesiritide;

inotropic agents (*cardiotonic agents*): cardiac glycosides (CG): digoxin; non-glycoside inotropic agents: levosimendan, dopamine, dobutamine, milrinone, istaroxime.

Principles of pharmacotherapy of chronic and acute heart failure. Mechanisms of action of drugs for the treatment of heart failure, selection criteria, side effects and restrictions on use. Structural determinants of the pharmacological activity of CG, the effect on the contractile and bioelectrical functions of the heart. The essence of the therapeutic effect of CG in cardiac decompensation. Application, side and toxic effects of CGs, contraindications to their use. Possible causes of digitalis intoxication, means of their prevention and treatment.

#### **5.5. Antiarrhythmic drugs**

Antiarrhythmic drugs (AAD) used for tachyarrhythmias: procainamide, lidocaine, propafenone, etacizine; propranolol, esmolol, sotalol; amiodarone, dronedarone, ibutilide; verapamil; adenosine

AAD used for bradyarrhythmias: M-anticholinergic blockers (atropine),  $\beta$ -adrenergic agonists (isoprenaline).

Classification of AAD according to electrophysiological and pharmacological effects on the myocardium. Basic mechanisms of antiarrhythmic action. Comparative



characteristics of AAD: influence on the basic functions of the heart (automaticity, excitability, conductivity, contractility), electrocardiogram, blood pressure, stroke volume, neurovegetative innervation. Indications and contraindications for the use of AAD, selection criteria. Arrhythmogenic and other side effects of AAD.

## **6. Drugs affecting the blood system**

### *Drugs affecting hematopoiesis.*

Medicines used for anemia: iron sulfate and other ferrous iron salts, iron (III) hydroxide polymaltosate, cyanocobalamin, folic acid, epoetin alpha and beta, antilymphocyte globulin. Causes of anemia, principles of pharmacotherapy of anemia. Poisoning with iron preparations, antidotes (deferoxamine).

Agents that stimulate leukopoiesis: molgramostim, filgrastim, lenograstim, methyluracil. Causes of leukopenia, principles of pharmacotherapy and prevention of leukopenia.

Drugs that inhibit hematopoiesis (anti-cancer drugs).

### *Agents affecting hemostasis.*

Classification of agents regulating hemostasis, principles and mechanisms of action, main indications for use, complications. Principles of treatment and prevention of acute arterial and venous thrombosis.

Antiplatelet agents (antiplatelet agents): acetylsalicylic acid, ticagrelor, clopidogrel, abciximab, tirofiban.

Anticoagulants: heparin, enoxaparin, dalteparin, antithrombin III, dabigatran, rivaroxaban, fondaparinux, bivalirudin, warfarin.

Thrombolytic agents: fibrinolytin, streptokinase, alteplase.

Hemostatic agents: eltrombopag, etamsylate, menadione, calcium salts, tranexamic acid, coagulation factor VIII, coagulation factor IX; fibrinogen, thrombin.

## **7. Drugs affecting the central nervous system**

### **7.1. General anesthetics. Ethanol. Anticonvulsants and antiparkinsonian drugs**

Definition of anesthesia. Inhalation and non-inhalation anesthesia. Stages of anesthesia. Requirements for an ideal drug for general anesthesia. Molecular and neurophysiological mechanisms of action of anesthetics.

Inhalation anesthetics: halothane, isoflurane, sevoflurane, dinitrogen oxide (nitrous oxide); concept of the activity of inhalation anesthetics (minimum alveolar concentration).

Non-inhalation anesthetics: sodium thiopental, propofol, ketamine.

Clinical use of anesthetics, types of anesthesia, concept of the breadth of narcotic action, side effects of anesthetics.

*Ethanol.* Local and resorptive effect of ethyl alcohol; application in medicine. Acute ethyl alcohol poisoning, medical assistance. Chronic ethyl alcohol poisoning (alcoholism): principles and means of treatment (disulfiram, apomorphine, acamprosate).

*Antiepileptic drugs* (sodium valproate, phenytoin, carbamazepine, lamotrigine, gabapentin, pregabalin, ethosuximide, levetiracetam, phenobarbital): mechanisms of action, application, side effects.

*Means to reduce spasticity:* centrally acting muscle relaxants (baclofen,

tizanidine, tolperisone), dantrolene: mechanisms of action, side and toxic effects

*Antiparkinsonian drugs*: levodopa, amantadine, selegiline, trihexyphenidyl, pramipexole. The use of DOPA decarboxylase inhibitors (carbidopa, benserazide) and COMT inhibitors (entacapone) to reduce side effects and increase the effectiveness of levodopa. Principles of drug correction of extrapyramidal disorders. Pharmacological effects of antiparkinsonian drugs, pharmacokinetics, side effects.

## 7.2. Analgesics

Modern ideas about the systems of perception and regulation of pain in the body. Nociceptive system: specific and nonspecific pathways for pain impulses; pain mediators. Antinociceptive system, mediators of the antinociceptive system and their precursors. Opiate receptors – localization, heterogeneity ( $\mu$ -,  $\kappa$ -,  $\delta$ -,  $\sigma$ -), activation effects.

### *Narcotic analgesics (opioids) and their antagonists*

Opioid receptor agonists: morphine, codeine, dihydrocodeine, trimeperidine, fentanyl, methadone.

Agonists-antagonists (pentazocine) and partial agonists of opioid receptors (buprenorphine).

Opioid antagonists: naloxone, naltrexone.

Molecular and cellular mechanisms of action, main pharmacological effects, pharmacokinetics of opioids. Characteristics of the main groups of opioids. Areas of medical use of narcotic analgesics, their side and toxic effects. Acute opioid poisoning and principles of its pharmacotherapy. Chronic opioid toxicity and drug dependence; principles of pharmacotherapy of drug addiction and withdrawal syndrome. Opioid drug interactions.

*Non-narcotic analgesics* (nefopam, paracetamol, ibuprofen, diclofenac, ketorolac, acetylsalicylic acid, metamizole sodium, combined agents) and analgesics of mixed action (tramadol, tapendalol): mechanisms of analgesic action, application, side effects, contraindications. Comparative characteristics of non-narcotic and narcotic analgesics. The concept of neuroleptanalgesia and ataralgesia.

### *Drugs used for neuropathic pain syndromes*

Principles of pharmacotherapy for migraine. Drugs for the relief of acute attacks: acetylsalicylic acid, paracetamol, 5HT<sub>1</sub>-receptor agonists (sumatriptan), ergot alkaloids (ergotamine), antiemetics (metoclopramide). Medicines for the prevention of migraine attacks: pizotifen, erenumab,  $\beta$ -blockers, tricyclic antidepressants, valproic acid, calcium channel blockers, cyproheptadine.

Drugs for the treatment of acute and chronic pain syndromes (auxiliary drugs): clonidine, amitriptyline, carbamazepine, gabapentin, corticosteroids, baclofen, diphenhydramine, phenytoin, valproic acid; mechanisms of their analgesic action, application.

## 7.3. Anxiolytic and sedative-hypnogenic drugs. Antipsychotics

### *Anxiolytic (tranquilizers) and sedative-hypnogenic drugs*

Anxiolytic, sedative and hypnogenic effects – essence, similarities and differences. Chemical classes and pharmacological groups of drugs used for psychoneurotic disorders and sleep disorders.

Anxiolytics: alprazolam, diazepam, oxazepam, chlordiazepoxide, buspirone



hydrochloride, afobazole.

Sedatives (calming agents): herbal remedies (valerian, motherwort); bromides (sodium bromide); combined agents (Corvalol).

Hypnogenic drugs: triazolam, nitrazepam, zaleplon, zopiclone, zolpidem, chloral hydrate; melatonin, ramelteon; suvorexant.

Neurophysiological and molecular mechanisms of action of anxiolytic and sedative-hypnogenic drugs. Pharmacological, side and toxic effects, areas of application of anxiolytics and sedative-hypnogenic drugs, restrictions on their use. Acute benzodiazepine poisoning, benzodiazepine antagonist (flumazenil).

#### *Antipsychotics (neuroleptics)*

Antipsychotics as a special class of psychopharmacological drugs. Concept of neuroplegia. Antipsychotics: chlorpromazine, flupentixol, haloperidol, droperidol, clozapine, risperidone, aripiprazole, cariprazine. Neurophysiological effects and mechanisms of antipsychotic action, principles of use, side and toxic effects (effects on the central nervous system, autonomic functions, endocrine system). Comparative characteristics of antipsychotic drugs, features of therapeutic and side effects of atypical antipsychotic drugs.

### **7.4. Antidepressants, normothimics, nootropics, psychostimulants, analeptics**

#### *Antidepressants (thymoanaleptics).*

Tricyclic antidepressants: imipramine, amitriptyline.

Selective neuronal reuptake inhibitors of norepinephrine and serotonin (venlafaxine).

Selective neuronal serotonin reuptake inhibitors: fluoxetine, sertraline, escitalopram, vortioxetine.

Selective inhibitors of neuronal reuptake of norepinephrine (maprotiline, reboxetine).

Atypical antidepressants: mirtazapine, mianserin, tianeptine, trazodone, bupropion.

Monoamine oxidase inhibitors (moclobemide).

Principles of pharmacotherapy of depressive conditions, pharmacodynamics (effect on biogenic amines of the brain, receptor and post-receptor effects) and pharmacokinetics of antidepressants, use and side effects.

*Normothymic (antimanic) drugs:* lithium salts (lithium carbonate), anticonvulsants, antipsychotics, benzodiazepines. Mechanism of action and pharmacokinetics of lithium salts. The use of lithium drugs in medicine: indications, side effects, contraindications.

Nootropic drugs: piracetam, vinpocetine, nimodipine, donepezil, memantine, cinnarizine, cortexin.

Psychostimulants: caffeine, mesocarb, methylphenidate.

Analeptics: almitrin, niketamide, doxapram, caffeine sodium benzoate.

Molecular and neurophysiological mechanisms of action, pharmacological effects, application, side effects, indications and contraindications for the use of nootropic, psychostimulant, analeptic drugs.



## 8. Agents regulating tissue metabolism

### 8.1. Hormonal and antihormonal agents. Drugs affect the tone and contractile activity of the myometrium

Hormones, their synthetic analogues, substitutes and antagonists, sources of production, principles of biological standardization and dosing, classification.

#### *Preparations of hypothalamic and pituitary hormones*

Hypothalamic hormone preparations: octreotide, gonadorelin, goserelin, protirelin.

Preparations of hormones of the anterior lobe of the pituitary gland: somatropin, gonadotropins (urofollitropin, human chorionic gonadotropin, luteinizing hormone, menotropins), thyrotropin.

Preparations of hormones of the posterior lobe of the pituitary gland: oxytocin, desmopressin, terlipressin.

Pituitary hormone antagonists (danazol, bromocriptine).

The influence of hypothalamic and pituitary hormone preparations on hormonal status, pharmacological effects, application.

Preparations of pineal gland hormones (melatonin and other melatonin receptor agonists): pharmacological activity, use in medicine.

#### *Thyroid and antithyroid drugs.*

Thyroid hormone preparations: sodium levothyroxine ( $T_4$ ), liothyronine ( $T_3$ ), their therapeutic use.

Antithyroid drugs (thiamazole, propylthiouracil, iodides, radioactive iodine,  $\beta$ -blockers), mechanisms of action, application, side effects and complications.

#### *Pancreatic hormonal drugs and synthetic antidiabetic agents.*

The effect of insulin on metabolism. Short- and long-acting insulin preparations (soluble insulin, isophane insulin, crystalline insulin-zinc suspension, combined insulin-zinc suspension, biphasic insulin), sources of production. Principles of dosing and routes of administration of insulin preparations, complications of insulin therapy.

Oral hypoglycemic agents (glibenclamide, gliclazide, metformin): mechanism of action, indications for use, side effects. Other antidiabetic drugs: increasing tissue sensitivity to insulin (pioglitazone), stimulating insulin release (repaglinide), inhibiting the absorption of carbohydrates from the intestine (acarbose), incretin mimetics (liraglutide, vildagliptin), inhibitors of renal glucose reabsorption (empagliflozin), amylin analogues (pramlintide).

Insulin antagonists (glucagon, epinephrine, glucocorticosteroids (GCS)), mechanisms of action, application.

#### *Preparations of hormones of the adrenal cortex.*

GCS: hydrocortisone, methylprednisolone, prednisolone, triamcinolone, dexamethasone, betamethasone, flucinolone. The effect of GCS on metabolism in the body. Anti-inflammatory and antiallergic properties of GCS, therapeutic use, side effects. Synthetic corticosteroids for topical use.

Mineralocorticoids: deoxycortone, fludrocortisone. Biological action and use of mineralocorticoids.

Inhibitors of corticosteroid synthesis (aminoglutethimide, mitotane).

*Female sex hormone preparations.*

Estrogen drugs: estradiol, ethinyl estradiol, hexestrol; estrogen receptor modulators (tamoxifen, raloxifene).

Progestin drugs: progesterone, dydrogesterone; gestagen receptor modulators – ulipristal.

Chemical structure and physiological significance of estrogens and gestagens, therapeutic use. Hormone replacement therapy for menopausal disorders.

Estrogen and progestin antagonists (anastrozole, mifepristone, fulvestrant), use in medicine.

Contraceptives: monophasic (Novinet, Regulon), biphasic (Anteovin), triphasic (Tri-Regol, Qlaira), norethisterone, levonorgestrel; principles of action, side effects.

*Male sex hormones, anabolic steroids.*

Androgenic drugs (testosterone and its esters): pharmacological activity, application, side effects. Antiandrogen drugs (finasteride, flutamide, nilutamide) use, side effects.

Anabolic steroids (nandrolone): the effect of anabolic steroids on metabolic processes, use, side effects.

*Hormonal regulators of mineral homeostasis and other agents affecting bone metabolism.*

Parathyroid hormone preparations (teriparatide), effect on phosphorus and calcium metabolism. Antiparathyroid drugs (calcitonin, paricalcitol). Bisphosphonates (alendronic acid, zoledronic acid). Vitamin D and analogs (cholecalciferol, alfacalcidol, paricalcitol). Mechanisms of action, use of agents affecting bone metabolism.

*Drugs that affect the tone and contractile function of the myometrium.*

Drugs to enhance labor (oxytocin, dinoprost); drugs to stop uterine bleeding (ergot drugs, oxytocin), tocolytic drugs (hexoprenaline, atosiban): mechanisms of action, pharmacological effects, application.

**8.2. Anti-inflammatory and anti-gout drugs**

GCS: prednisolone, methylprednisolone, triamcinolone, dexamethasone, betamethasone. Mechanisms of action, basic regimens for the use of GCS, side effects of GCS and ways to prevent them.

Nonsteroidal anti-inflammatory drugs (NSAIDs): acetylsalicylic acid, diclofenac, ibuprofen, naproxen, indomethacin, etodolac, nabumetone, meloxicam, celecoxib, etoricoxib.

Mechanisms of anti-inflammatory action (effect on mediators and inflammatory cells, processes of prostaglandin synthesis (COX-1 and COX-2), monoamines, kinins, fibroblast proliferation, synthesis of acidic mucopolysaccharides, transcription factor NF- $\kappa$ B, cartilage tissue metabolism), other pharmacological effects of NSAIDs. Indications and contraindications for the use of NSAIDs, side effects, their prevention.

*Antigout drugs:* uric acid synthesis inhibitors (allopurinol, febuxostat), uricosuric drugs (sulfapyrazone, probenecid), pegloticase; drugs used for acute attacks of gout (NSAIDs, corticosteroids, colchicine): mechanisms of action, application, side effects.



### 8.3. Antiallergic drugs. Immunomodulators. Vitamins and vitamin-like products

*Medicines used for immediate allergic reactions.*

Antihistamines (H<sub>1</sub>-histamine receptor blockers): diphenhydramine, clemastine, loratadine, cetirizine, cyproheptadine.

Mast cell membrane stabilizers (cromoglycic acid).

GCS: prednisolone, methylprednisolone, triamcinolone, dexamethasone, betamethasone.

Leukotriene receptor antagonists (montelukast).

Mechanisms of action of antiallergic drugs, comparative characteristics, indications for use, side effects.

Drugs used for anaphylactic shock (epinephrine, corticosteroids, dopamine, salbutamol, antihistamines): principles of action, routes of administration.

*Medicines used for delayed allergic reactions.*

Basic antirheumatic drugs: auranofin, penicillamine, chloroquine, sulfasalazine; and immunosuppressants for various purposes (cyclosporine, tacrolimus, sirolimus, mycophenolate mofetil, fingolimod, antilymphocyte immunoglobulins, monoclonal antibody preparations – basiliximab, adalimumab, tocilizumab, ustekinumab and others); cytotoxic agents - methotrexate.

*Immunomodulators.*

Immunoregulatory peptides (interferon gamma-1 b and other interferons); interferonogens (tiloron, arbidol); thymus preparations (thymogen); other immunomodulators: glatiramer acetate, inosine pranobex, herbal medicines (echinacea preparations, including in combinations) – mechanisms of action, use in medicine. Immunosuppressive properties of cytostatic agents (anti-cancer).

*Vitamins and vitamin-like products.*

Classification, sources of production, pharmacodynamics of vitamins, indications for use and side effects, features of action and comparative characteristics. Causes of hypovitaminosis, their prevention.

Water-soluble vitamins: thiamine, benfotiamine, pyridoxine, riboflavin, calcium pantothenate, folic acid, niacin, cyanocobalamin, ascorbic acid, rutin, quercetin.

Fat-soluble vitamins: retinol, ergocalciferol, alfacalcidol, phytomenadione, tocopherol. Hypervitaminosis when using retinol and ergocalciferol.

Vitamin-like compounds: choline chloride, inosine. Multivitamin and vitamin-mineral complexes. The concept of antivitamin.

## 9. Chemotherapeutic agents

### 9.1. The concept of chemotherapy. Principles of action of antibacterial agents. Antiseptics and disinfectants

Modern sources of antimicrobial agents. Criteria and basic principles of rational chemotherapy of infections. Principles of classification of antibiotics. Basic mechanisms of action of antibiotics. Principles of combination antibiotic therapy. Possible reasons for the failure of antimicrobial therapy. Side effects and complications of antibiotic therapy, their prevention and treatment. Resistance of microorganisms to antibiotics; mechanisms and ways to overcome it.

The concept of antiseptics and disinfection. Difference between antiseptics and chemotherapeutic agents. Requirements for antiseptics. Main groups of antiseptics:

Aromatic antiseptics:

phenol derivatives: phenol, resorcinol (resorcinol), birch tar, biclotymol;

nitrofurans derivatives – nitrofurazone;

dyes: brilliant green, methylthioninium chloride;

biguanides – chlorhexidine;

polyguanidines: biopag, phosphopag, ecopag.

Aliphatic antiseptics:

aldehydes: formaldehyde, glutaraldehyde;

alcohols: ethyl alcohol, isopropyl alcohol;

detergents: cetylpyridinium chloride, benzalkonium chloride, miramistin.

Halogen-containing compounds:

Iodine preparations: alcoholic iodine solution, iodoform;

iodophors: Lugol's solution, iodinol;

chlorine preparations: chloramine B.

Oxidizing agents: hydrogen peroxide, potassium permanganate.

Acids and alkalis: boric acid, ammonia preparations.

Metal compounds: silver proteinate (protargol), silver sulfadiazine, zinc sulfate, zinc oxide.

Other antiseptics: hexitidine, ambazon (pharyngosept); multicomponent products (Virkon).

Herbal preparations: lingonberry and bearberry leaves, calendula flowers, chamomile flowers, St. John's wort, chlorophyllipt, salvin.

Conditions that determine the antimicrobial activity of antiseptics, the mechanisms of action of antiseptics of different chemical groups. Features of the use of individual antiseptics. Principles of treatment of acute poisoning with antiseptics.

## 9.2. Antibiotics

$\beta$ -Lactam and other antibiotics that inhibit cell wall synthesis.

Penicillins: benzylpenicillin (sodium and potassium salts), benzathine benzylpenicillin (bicillin-1); phenoxymethylpenicillin, flucloxacillin, oxacillin, amoxicillin, temocillin, carbenicillin, piperacillin, ticarcillin, pivmecillinam; combination preparations of penicillins with  $\beta$ -lactamase inhibitors - clavulanic acid, sulbactam, tazobactam, avibactam.

Cephalosporins and cephamycins: cephalexin, cefradine, cefadroxil, cefazolin, cefaclor, cefuroxime, cefoxitin, cefotaxime, ceftazidime, ceftriaxone, cefixime, cefepime, ceftaroline fosamil, cefiderocol. Classification of cephalosporins by generation (I-IV), spectrum of antimicrobial activity, resistance to  $\beta$ -lactamases, route of administration.

Carbapenems (imipenem, meropenem, ertapenem, doripenem).

Monobactams (aztreonam).

Glycopeptides (vancomycin, teicoplanin).

*Antibiotics that disrupt the permeability of the cytoplasmic membrane.*

Polypeptides (polymyxin B).

Polyenes (nystatin, amphotericin B).



*Antibiotics that inhibit the synthesis of nucleic acids.*

Ansamycins (rifampicin).

*Antibiotics that inhibit protein synthesis.*

Aminoglycosides (aminocyclitols) (streptomycin, neomycin, gentamicin, tobramycin, amikacin).

Tetracyclines (tetracycline, doxycycline, minocycline).

Macrolides and azalides (erythromycin, clarithromycin, azithromycin, spiramycin).

Amphenicols (chloramphenicol).

Lincosamides (clindamycin).

Steroid antibiotics (fusidic acid).

Oxazolidinones (linezolid).

Streptogramins (quinupristin/dalfopristin).

Pharmacodynamics, spectrum of antibacterial action of antibiotics of various groups, routes of administration, dosing principles, side and toxic effects, contraindications. Principles of combination antibiotic therapy.

### **9.3. Synthetic antimicrobial agents. Antimycobacterial agents**

Sulfonamides: sulfadimidine, sulfadiazine, sulfadimethoxine, sulfafene, phthalylsulfathiazole, sulfacetamide, combinations of sulfonamides with trimethoprim (co-trimoxazole).

Hydroxyquinolines (nitroxoline).

Nitrofurans: nitrofurantoin, furazolidone.

Quinolones and fluoroquinolones: nalidixic acid, ofloxacin, ciprofloxacin, levofloxacin, moxifloxacin, delafloxacin.

Nitroimidazoles (metronidazole).

Pharmacodynamics of synthetic antimicrobial agents, spectrum of antimicrobial action, use, side effects and their prevention.

*Antimycobacterial agents*

Antituberculosis drugs: isoniazid, rifampicin, pyrazinamide, ethambutol, streptomycin, rifabutin, cycloserine, kanamycin, clofazimine, bedaquiline, delamanid, fluoroquinolones. Antileprosy drugs (dapsone, clofazimine, rifampicin).

Mechanisms of action, pharmacokinetics, adverse reactions of antimycobacterial agents. Basic and reserve anti-tuberculosis drugs; principles of pharmacotherapy of tuberculosis, concept of chemoprophylaxis of tuberculosis.

### **9.4. Antiviral and antimycotic agents**

Anti-influenza drugs: rimantadine, oseltamivir.

Antiherpetic drugs: acyclovir, valacyclovir, idoxuridine, foscarnet.

Medicines for the treatment of coronavirus infection (COVID-19): remdesivir, brincidofovir, molnupiravir; bamlanivimab.

Drugs for the treatment of respiratory syncytial infection: ribavirin, palivizumab.

Anticytomegalovirus drugs (ganciclovir).

Drugs for the treatment of HIV infection: maraviroc, zidovudine, nevirapine, raltegravir, saquinavir, enfuvirtide, ritonavir.

Drugs for the treatment of chronic viral hepatitis B: peginterferon alfa,

entecavir, tenofovir, adefovir, lamivudine.

Drugs for the treatment of chronic viral hepatitis C of all genotypes: glecaprevir with pibrentasvir, sofosbuvir in combinations: with ribavirin (with or without peginterferon alfa), with velpatasvir (with or without ribavirin), with velpatasvir and voxilaprevir. Other drug combinations: ledipasvir with sofosbuvir (with or without ribavirin) - genotypes 1,3,4,5 or 6; elbasvir with grazoprevir (with or without ribavirin) - genotypes 1 or 4; ribavirin with peginterferon alfa or peginterferon alfa for monotherapy.

Interferons (interferon alpha, interferon alpha-2a, interferon alpha-2b, interferon beta, interferon gamma-1b) and interferonogens (tiloron, arbidol).

Mechanisms of action, principles of use, side and toxic effects of antiviral agents.

*Antifungal agents* (amphotericin B, nystatin; griseofulvin, ketoconazole, clotrimazole, fluconazole, itraconazole, voriconazole, terbinafine, naftifine, flucytosine, caspofungin): pharmacodynamics, spectrum of antifungal action, indications for use, side and toxic effects.

### 9.5. Antiprotozoal and antiparasitic agents

*Antiprotozoal agents.*

Antimalarials: quinine, chloroquine, mefloquine, pyrimethamine, primaquine, doxycycline, sulfadoxine/pyrimethamine, atovaquone/proguanil, lumefantrine/artemether.

Antiamoebic agents: metronidazole, quiniofphone, doxycycline, chloroquine, paromomycin.

Medicines used for trichomoniasis: tinidazole, metronidazole.

Medicines used for giardiasis (giardiasis): metronidazole, tinidazole, furazolidone.

Drugs used for toxoplasmosis: pyrimethamine in combination with sulfonamides (sulfadiazine, sulfadimidine) and antibiotics (clindamycin, azithromycin).

Drugs used for leishmaniasis: sodium stibogluconate, miltefosine.

Drugs used for pneumocystosis: co-trimoxazole, pentamidine isethionate (inhalation), atovaquone.

Drugs used for trypanosomiasis: pentamidine isethionate, suramin, nifurtimox.

Principles of chemotherapy for protozoal infections, mechanisms of action of antiprotozoal drugs, application, side effects. The concept of individual and public chemoprophylaxis of malaria.

*Antiparasitic (anthelmintic) drugs* (mebendazole, pyrantel, albendazole, ivermectin, piperazine adipate, levamisole, praziquantel, niclosamide, bithionol): mechanisms of action, principles of use, side effects. Drugs used for intestinal nematodes, cestodes and trematodes: properties, application features, side effects. General characteristics of drugs used for extraintestinal helminthiasis.

### 9.6. Anticancer drugs

Principles of chemotherapy for malignant neoplasms. Classification of anti-blastoma drugs: alkylating agents (cyclophosphamide, melphalan, busulfan), antimetabolites (methotrexate, fluorouracil, cytarabine, mercaptopurine), drugs that



disrupt mitosis (vincristine, paclitaxel, etoposide), antibiotics (bleomycin, doxorubicin, mitomycin), enzymes (L-asparaginase), platinum preparations (cisplatin). Targeted anti-blastoma drugs (imatinib, bevacizumab, bortezomib and others). Targets and mechanisms of action of anti-blastoma drugs, resistance of tumor cells to anti-tumor drugs and its overcoming, complications of tumor chemotherapy, their prevention.

### **10. Drugs affecting respiratory function**

*Drugs for the treatment of bronchial asthma and relief of bronchospasm:*  $\beta$ -adrenomimetics (salbutamol, salmeterol, formoterol), glucocorticosteroids (beclomethasone, budesonide), inhibitors of the release of allergy mediators (cromoglycic acid, ketotifen), M-anticholinergic blockers (ipratropium, tiotropium), leukotriene receptor antagonists (montelukast), phosphodiesterase inhibitors (aminophylline, theophylline and prolonged forms), immunoglobulin E inhibitors (omalizumab). The choice of drugs for pharmacotherapy of bronchial asthma, relief and prevention of asthmatic attacks.

*Respiratory stimulants:* almitrin, doxapram, bemegride, etimizol, niketamide.

*Surfactants* (beractant, poractant alpha) and stimulators of their synthesis (ambroxol), routes of administration.

*Expectorants and mucolytics:* thermopsis preparations, potassium iodide, guaifenesin, ambroxol, acetylcysteine, carbocysteine, dornase alfa.

*Antitussives:* dextromethorphan, prenoxdiazine, butamirate, codeine phosphate and other products containing codeine.

Principles of action of different groups of drugs that affect the functions of the respiratory system, application, side effects.

*Drugs used in the treatment of pulmonary edema:* morphine, furosemide, mannitol, sodium nitroprusside, hexamethonium, aminophylline, ethyl alcohol - principles of action and application.

### **11. Drugs affecting the functions of the digestive organs**

General characteristics of drugs used to correct impaired functions of the digestive organs. Main classes of drugs, mechanisms of action, pharmacological and side effects, application.

*Medicines for the treatment of stomach and duodenal ulcers*

Antacids and simethicone: calcium carbonate, magnesium hydroxide, aluminum phosphate and their combinations, sodium bicarbonate, simethicone containing antacids.

Proton pump blockers: omeprazole, lansoprazole, rabeprazole.

Histamine H<sub>2</sub>-receptor blockers: famotidine, ranitidine.

Selective M<sub>1</sub>-cholinergic blockers (pirenzepine).

Gastrin receptor blockers (proglumide).

Agents that have a protective effect on the mucous membrane of the stomach and intestines (gastroprotectors): bismuth tripotassium dicitrate, sucralfate, misoprostol.

Helicobacter pylori eradication agents: omeprazole, bismuth preparations, metronidazole, clarithromycin, amoxicillin.

*Drugs affecting the tone and motility of the gastrointestinal tract*

Drugs that inhibit motility: anticholinergics (dicycloverine, atropine); antispasmodics of myotropic and mixed action (drotaverine, pinaverium bromide).

Antidiarrheals: opiate receptor agonists (loperamide); adsorbents and astringents.

Motor stimulants: cholinomimetics (pyridostigmine bromide), dopamine receptor antagonists (metoclopramide).

Laxatives: senna preparations, bisacodyl, magnesium sulfate, lactulose, methylcellulose, vaseline oil. Localization of action and speed of onset of the laxative effect, indications and contraindications for the use of laxatives.

Emetics (apomorphine).

Antiemetics: ondansetron, palonosetron, metoclopramide, domperidone, promethazine, hyoscine hydrobromide, dexamethasone, nabilone, aprepitant. The choice of antiemetic agent depends on the cause and mechanism of vomiting.

#### *Hepatotropic agents*

Choleretic agents: dehydrocholic acid, osalmide, magnesium sulfate, drotaverine, M-anticholinergic agents, herbal remedies.

Cholelitholetics (ursodeoxycholic acid).

Hepatoprotectors: betaine, ademetonine, essentielle.

*Drugs affecting pancreatic function:* diluted hydrochloric acid, pancreatin, cholecystokinin, M-cholinergic blockers, proteinase inhibitors (aprotinin). Principles of pharmacotherapy of acute and chronic pancreatitis.

#### *Drugs affecting appetite and digestive processes*

Antianorexic drugs (increasing appetite): wormwood tincture, cyproheptadine.

Anorexic drugs: phenylpropanolamine, dexfenfluramine. Restrictions and dangers of use, side effects of anorexic drugs.

Agents that improve digestive processes: pepsin, tilactase, diluted hydrochloric acid.

Drugs for the treatment of obesity: anorexic agents, intestinal lipase inhibitors (orlistat), agents that create a saturation effect (methylcellulose), hypoglycemic agents (metformin, acarbose).

## **12. Drug interactions. Antidotes and principles of medical care for acute drug poisoning**

Co-prescription of drugs (polypharmacotherapy or combination therapy). Indications for combination therapy. Types and mechanisms of drug interactions. Possible results of drug interactions. Pharmaceutical and pharmacological incompatibility.

Classification of pharmacological substances by degree of toxicity and danger. Toxicokinetics, toxicodynamics. Basic mechanisms of toxic action. Principles and means of medical care for acute drug poisoning. The main groups of antidotes: toxicotropic, toxic-kinetic, pharmacological antagonists, immunological antidotes (antitoxic serums). Mechanisms of action of antidotes, conditions and limitations of their use. Prevention of acute drug poisoning.



**CURRICULAR CHART OF ACADEMIC DISCIPLINE «PHARMACOLOGY»  
MODULE «MEDICAL-BIOLOGICAL MODULE 2»**

Section, topic #	Title of section, topic	Number of academic hours				Form of control
		lectures (including supervised work)	supervised student work	practical	self-studies	
<b>5th semester</b>						
<b>1.</b>	<b>Introduction to pharmacology and general prescription</b>	<b>2</b>	<b>0,5</b>	<b>9</b>	<b>6</b>	
1.1	Subject of pharmacology. Terminology. Sources and stages of creation of drugs. Legislation of drugs	2	0,5	-	1	Interview, test
1.1.1	Subject of pharmacology. Terminology. Sources and stages of creation of drugs. Legislation of drugs.	-	-	3	2	Report on classroom practical exercises with their oral defense, written reports on classroom (home) practical exercises
1.2	General prescription. Rules of writing out of medicines in various dosage forms. Solid dosage forms	-	-	3	2	Report on classroom practical exercises with their oral defense, written reports on classroom (home) practical exercises with their oral defense
	General prescription. Rules of writing out of medicines in various dosage forms. Liquid dosage forms	-	-	3	2	Report on classroom practical exercises with their oral defense, written reports on classroom (home) practical exercises with their oral defense
	General prescription. Rules of writing out of medicines in various dosage forms. Dosage forms for injections. Soft dosage forms	-	-	3	1	Report on classroom practical exercises with their oral defense, written reports on classroom (home) practical exercises with their oral defense
<b>2.</b>	<b>Pharmacokinetics of drugs</b>	<b>4</b>	<b>1,5</b>	<b>6</b>	<b>6</b>	
2.1	Basics of pharmacokinetics	2	1	3	3	Interview, test papers, electronic tests



2.2	Principles of drug dosing	2	0,5	3	3	Reports on classroom (home) practical exercises, reports on home practical exercises with their oral defense
<b>3.</b>	<b>Pharmacodynamics of drugs</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>3</b>	Interview, test papers, electronic tests
	<b>Final lesson on the topics: «General prescription», «Pharmacokinetics of drugs», «Pharmacodynamics of drugs»</b>	-	-	<b>3</b>	<b>3</b>	Colloquium, test papers, electronic tests
<b>4.</b>	<b>Drugs affecting the peripheral nervous system</b>	<b>4</b>	<b>1</b>	<b>12</b>	<b>9</b>	
4.1	Cholinergic drugs	2	0,5	3	2	Interview, report on classroom practical exercises with their oral defense, electronic tests
4.2	Adrenergic drugs. Drugs affecting afferent transmission of nerve impulses	2	0,5	-	-	
	Adrenergic drugs	-	-	3	2	Interview, report on classroom practical exercises with their oral defense, electronic tests
	Adrenergic drugs. Drugs affecting afferent transmission of nerve impulses	-	-	3	2	Interview, report on classroom practical exercises with their oral defense, electronic tests
	Final lesson on the topic: «Drugs affecting the peripheral nervous system»	-	-	3	3	Colloquium, test papers, electronic tests
<b>5.</b>	<b>Drugs affecting the cardiovascular system and kidney function</b>	<b>10</b>	<b>3</b>	<b>18</b>	<b>15</b>	
5.1	Diuretics and other drugs affecting the function of the urinary system	2	0,5	3	1	Interview, electronic tests
5.2	Antihypertensives and other agents that regulate systemic blood pressure	2	0,5	3	3	Interview, electronic tests
5.3	Antianginal agents. Means for correcting local blood flow disorders. Lipid-lowering drugs	2	0,5	3	3	Interview, electronic tests
5.4	Drugs for the treatment of heart failure. Cardiotonic drugs	2	1	3	3	Interview, electronic tests
5.5	Antiarrhythmic drugs	2	0,5	3	2	Interview, electronic tests
	Final lesson on the topic: «Drugs affecting the cardiovascular system and kidney function»	-	-	3	3	Colloquium, test papers, electronic tests



<b>6.</b>	<b>Drugs affecting the blood system</b>	<b>2</b>	<b>1</b>	<b>6</b>	<b>3</b>	.
	Drugs affecting the blood system	2	1	-	-	
	Drugs affecting hematopoiesis	-	-	3	1	Interview, test papers, electronic tests
	Agents affecting hemostasis	-	-	3	2	Interview, test papers, electronic tests
	<b>6th semester</b>					
<b>7.</b>	<b>Drugs affecting the central nervous system</b>	<b>8</b>	<b>3</b>	<b>12</b>	<b>12</b>	
7.1	General anesthetics. Ethanol. Anticonvulsants and antiparkinsonian drugs	2	0,5	3	3	Interview, test papers, electronic tests
7.2	Analgesics	2	0,5	3	3	Interview, test papers, electronic tests
7.3	Anxiolytic and sedative-hypnogenic drugs. Antipsychotics	2	1	3	3	Interview, test papers, electronic tests
7.4	Antidepressants, normothimics, nootropics, psychostimulants, analectics	2	1	3	3	Interview, test papers, electronic tests
<b>8.</b>	<b>Means regulating tissue metabolism</b>	<b>6</b>	<b>2</b>	<b>12</b>	<b>12</b>	
8.1	Hormonal and antihormonal drugs	2	1	-	-	
8.1	Hormonal and antihormonal agents. Preparations of hypothalamic and pituitary hormones. Thyroid and antithyroid drugs. Pancreatic hormonal drugs and synthetic antidiabetic agents	-	-	3	3	Interview, test papers, electronic tests
	Preparations of hormones of the adrenal cortex. Female sex hormone preparations. Male sex hormones, anabolic steroids. Hormonal regulators of mineral homeostasis and other agents affecting bone metabolism. Drugs that affect the tone and contractile function of the myometrium					Interview, test papers, electronic tests
8.2	Anti-inflammatory and anti-gout drugs	2	0,5	3	3	Interview, test papers, electronic tests
8.3	Antiallergic drugs. Immunomodulators. Vitamins and vitamin-like products	2	0,5	3	3	Interview, test papers, electronic tests
<b>9.</b>	<b>Chemotherapeutic agents</b>	<b>8</b>	<b>2</b>	<b>15</b>	<b>15</b>	
9.1	The concept of chemotherapy. Principles of action of antibacterial agents. Antiseptics and disinfectants	2	0,5	3	3	Interview, test papers, electronic tests
9.2	Antibiotics	2	0,5	3	3	Interview, test papers, electronic tests
9.3	Synthetic antimicrobial agents. Antimycobacterial agents	-	-	3	3	Interview, test papers, electronic tests
9.4	Antiviral and antimycotic agents	2	0,5	3	3	Interview, test papers, electronic tests
9.5	Antiviral and antimycotic agents. Antiprotozoal and	-	-	3	2	Interview, test papers, electronic tests

	antiparasitic agents								
9.6	Anticancer drugs	2	0,5	-	-	1			Electronic tests
	Final lesson on the topic: «Chemotherapeutic agents»	-	-	3	-	-			Interview, test papers, electronic tests
10.	<b>Drugs affecting respiratory function</b>	-	-	-	-	3			Interview, test papers, electronic tests
11.	<b>Drugs affecting the functions of the digestive system</b>	2	1	3	3	3			Interview, test papers, electronic tests
12.	<b>Drug interactions. Antidotes and principles of medical care for acute drug poisoning</b>	-	-	3	-	3			Interview, test papers, electronic tests. Examination
	<b>Total hours</b>	<b>48</b>	<b>16</b>	<b>105</b>		<b>93</b>			



## INFORMATIONAL AND INSTRUCTIONAL PART

### LITERATURE

#### **Basic (relevant):**

1. Kharkevitch, D. A. Pharmacology : textbook for medical students.– Moscow : GEOTAR-Media Publishing Group, 2017. – 680 p.
2. Основы фармакологии = Essentials of pharmacology : учеб. пособие для иностр. студентов учреждений высш. образования по спец. «Лечебное дело», «Педиатрия» / В. И. Козловский [и др.]. – Минск : Вышэйшая школа, 2019. – 287 с.

#### **Additional:**

3. Katzung, B. G. Basic and Clinical Pharmacology / B. G. Katzung, A. J. Trevor. - New York : McGraw-Hill Medical, 2021. - 1264 p.
4. Trevor, A. G. Katzung & Trevor's Pharmacology Examination and Board Review / A. G. Trevor, B. G. Katzung, M. Knudering-Hall. - New York : McGraw-Hill Medical, 2015.- 592 p.
5. Brunton, L. L. Goodman & Gilman's The Pharmacological basis of Therapeutics / L. L. Brunton, B. Knollman, R. Hilal-Dandan. – 13th ed. – McGraw-Hill, 2017. - 1440 p.
17. Vauchok, A. U. Pharmacology Tests for the specialty «General Medicine» / А. В. Волчек, Н. А. Бизунок, Б. В. Дубовик, А. В. Шелухина. – БГМУ, 2020. – 107 p.

#### **METHODOLOGICAL RECOMMENDATIONS FOR ORGANIZING AND PERFORMING INDEPENDENT WORK OF STUDENTS IN AN ACADEMIC DISCIPLINE**

The time allocated for independent work can be used by students to:

- preparation for lectures and practical classes;
- preparation for colloquiums, tests and exams in the academic discipline;
- elaboration of topics (questions) submitted for independent study;
- studying topics and problems that are not covered in lectures and practical classes;
- problem solving;
- preparation of thematic reports, abstracts, presentations;
- performing practical tasks.

#### **METHODOLOGICAL RECOMMENDATIONS FOR THE ORGANIZATION AND PERFORMANCE OF SUPERVISED STUDENT INDEPENDENT WORK IN THE ACADEMIC DISCIPLINE**

Main forms of supervised student independent work:

- studying topics and problems that have not been discussed at the lectures;
- taking notes of original sources (sections of anthologies, collections of documents, monographs, textbooks);
- computer testing;
- preparation of tests for the organization of mutual assessment.

Control of supervised student independent work is carried out in the forms of:

test paper;  
 final class, colloquium in the form of an oral interview, written work, testing;  
 individual interview.

#### **LIST OF AVAILABLE DIAGNOSTIC TOOLS**

The following forms are used to diagnose competencies:

**Oral form:**

interviews;  
 colloquium.

**Written form:**

test papers;  
 written reports on classroom (home) practical exercises.

**Oral and written form:**

reports on classroom practical exercises with their oral defense;  
 reports on home practical exercises with their oral defense;  
 examination.

**Technical form:**

electronic tests.

#### **LIST OF AVAILABLE TEACHING METHODS**

Traditional method (lecture, laboratory practicals);

Active (interactive) methods:

- Problem-Based Learning (PBL);
- Team-Based Learning (TBL);
- Case-Based Learning (CBL);
- Research-Based Learning (RBL).

#### **LIST OF PRACTICAL SKILLS**

1. Working with electronic information databases and reference guides on drugs.
2. The choice of the method of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy.
3. Calculation of an individual dosage regimen for pathological conditions that alter the clearance and volume of distribution of drugs.
4. Writing and filling out a doctor's prescription when prescribing medications in various dosage forms.

#### **LIST OF EQUIPMENT USED**

Visual aids (illustrative materials - tables, pictures, slides):

1. absorption of the substance;
2. substance distribution;
3. excretion and elimination;
4. steady-state equilibrium concentration ( $C_{ss}$ );
5. pharmacodynamics;
6. ligand-receptor interactions;



7. autonomic innervation of internal organs;
8. cholinergic mediation;
9. N-cholinergic mediation and blockade;
10. adrenergic mediation;
11. dopamine effects of dopaminergic drugs;
12. serotonin and serotonergic agents;
13. diuretics;
14. pharmacodynamics of calcium channel blockers;
15. pharmacodynamics of organic nitrates;
16. compensatory responses to vasodilation;
17. principles of action of antiarrhythmic drugs;
18. RAAS inhibitors;
19. medicines for the treatment of heart failure;
20. pharmacology of hemostasis;
21. pharmacology of the central nervous system;
22. anticonvulsants;
23. principles of pharmacotherapy for parkinsonism;
24. pharmacology of pain (Part I, analgesics);
25. pharmacology of pain (Part II «targets of analgesics»);
26. pharmacotherapy for migraine;
27. anti-inflammatory drugs;
28. pharmacotherapy of gout;
29. formation and implementation of allergic reactions;
30. principles of action of antiallergic drugs;
31. medicines for the treatment of diseases of the stomach and duodenum;
32. anti-obstipation agents;
33. hormonal and antihormonal agents (estrogens);
34. hormonal and antihormonal drugs (thyroid);
35. principles of action of antibacterial agents;
36. antiviral agents;
37. pharmacotherapy of malaria.

#### LIST OF LECTURES

##### *5th semester:*

1. Subject of pharmacology. Terminology. Sources and stages of creation of drugs. Legislation of drugs.
2. Basics of pharmacokinetics.
3. Principles of drug dosing.
4. Pharmacodynamics of drugs.
5. Cholinergic drugs.
6. Adrenergic drugs. Drugs affecting afferent transmission of nerve impulses.
7. Diuretics and other drugs affecting the function of the urinary system.
8. Antihypertensives and other agents that regulate systemic blood pressure.
9. Antianginal agents. Means for correcting local blood flow disorders. Lipid-

lowering drugs.

10. Drugs for the treatment of heart failure. Cardiotonic drugs.
11. Antiarrhythmic drugs.
12. Drugs affecting the blood system.

*6th semester*

1. General anesthetics. Ethanol. Anticonvulsants and antiparkinsonian drugs.
2. Analgesics.
3. Anxiolytic and sedative-hypnogenic drugs. Antipsychotics.
4. Antidepressants, normothimics, nootropics, psychostimulants, analeptics.
5. Hormonal and antihormonal agents.
6. Anti-inflammatory and anti-gout drugs.
7. Antiallergic drugs. Immunomodulators. Vitamins and vitamin-like products.
8. The concept of chemotherapy. Principles of action of antibacterial agents.

Antiseptics and disinfectants.

9. Antibiotics.
10. Antiviral and antimycotic agents.
11. Anticancer drugs.
12. Drugs affecting the functions of the digestive system.

#### LIST OF PRACTICAL CLASSES

*5th semester:*

1. Subject of pharmacology. Terminology. Sources and stages of creating of drugs. Legislation of drugs. General prescription. Rules of writing out of medicines in various dosage forms. Solid dosage forms.
2. General prescription. Rules of writing out of medicines in various dosage forms. Liquid dosage forms.
3. General prescription. Rules of writing out of medicines in various dosage forms. Dosage forms for injections. Soft dosage forms.
4. Basics of pharmacokinetics.
5. Principles of drug dosing.
6. Pharmacodynamics of drugs.
7. Final lesson on the topics: «General formulation», «Pharmacokinetics of drugs», «Pharmacodynamics of drugs».
8. Cholinergic drugs.
9. Adrenergic drugs.
10. Adrenergic drugs. Drugs affecting afferent transmission of nerve impulses.
11. Final lesson on the topic: «Drugs affecting the peripheral nervous system».
12. Diuretics and other drugs affecting the function of the urinary system.
13. Antihypertensives and other agents that regulate systemic blood pressure.
14. Antianginal agents. Means for correcting local blood flow disorders.

Lipid-lowering drugs.

15. Drugs for the treatment of heart failure. Cardiotonic drugs.
16. Antiarrhythmic drugs.



17. Final lesson on the topic: «Drugs affecting the cardiovascular system and kidney function».

18. Drugs affecting hematopoiesis.

19. Agents affecting hemostasis.

*6th semester*

1. General anesthetics. Ethanol. Anticonvulsants and antiparkinsonian drugs.

2. Analgesics.

3. Anxiolytic and sedative-hypnogenic drugs. Antipsychotics.

4. Antidepressants, normothimics, nootropics, psychostimulants, analeptics.

5. Hormonal and antihormonal agents. Preparations of hypothalamic and pituitary hormones. Thyroid and antithyroid drugs. Pancreatic hormonal drugs and synthetic antidiabetic agents.

6. Preparations of hormones of the adrenal cortex. Female sex hormone preparations. Male sex hormones, anabolic steroids. Hormonal regulators of mineral homeostasis and other agents affecting bone metabolism. Drugs that affect the tone and contractile function of the myometrium.

7. Anti-inflammatory and anti-gout drugs.

8. Antiallergic drugs. Immunomodulators. Vitamins and vitamin-like products

9. The concept of chemotherapy. Principles of action of antibacterial agents.

Antiseptics and disinfectants.

10. Antibiotics.

11. Synthetic antimicrobial agents. Antimycobacterial agents.

12. Antiviral and antimycotic agents. Antiprotozoal and antiparasitic agents.

13. Final lesson on the topic: «Chemotherapeutic agents».

14. Drugs affecting respiratory function.

15. Drugs affecting the functions of the digestive system.

16. Drug interactions. Antidotes and principles of medical care for acute drug poisoning.

**PROTOCOL OF CURRICULUM APPROVAL**

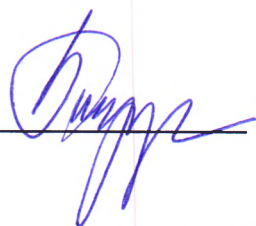
Name of the academic discipline with which approval is required	Department name	Proposals for changes in the content of the curriculum of a higher education institution in an academic discipline	The decision made by the department that developed the curriculum (indicating the date and protocol number)
1. Internal diseases	Internal Diseases	No offers	Take into account Protocol No. 9 of 05/19/2023
2. Psychiatry and narcology	Psychiatry and Medical Psychology	No offers	Take into account Protocol No. 9 of 05/19/2023
3. General surgery	General Surgery	No offers	Take into account Protocol No. 9 of 05/19/2023
5. Therapy module 2	Skin and Venereal Diseases, Phthisiopulmonology, Nervous and Neurosurgical Diseases, Polyclinic Therapy	No offers	Take into account Protocol No. 9 of 05/19/2023
6. Surgical module 2	Diseases of the Ear, Nose and Throat, Eye Diseases, Anesthesiology and Resuscitation	No offers	Take into account Protocol No. 9 of 05/19/2023
7. Therapeutic module 3	Infectious diseases, Endocrinology, Medical rehabilitation and physiotherapy, Clinical pharmacology, Cardiology and internal medicine	No offers	Take into account Protocol No. 9 of 05/19/2023
8. Surgical module 3	Surgical diseases, Oncology, Traumatology and orthopedics, Urology	No offers	Take into account Protocol No. 9 of 05/19/2023



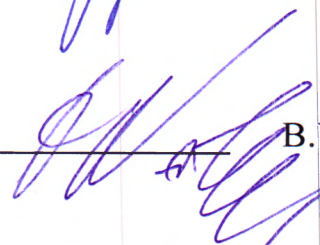
9. Obstetrics and gynecology module	Obstetrics and Gynecology	No offers	Take into account Protocol No. 9 of 05/19/2023
10. Pediatric module	1st Department of Childhood Diseases, 2nd Department of Childhood Diseases, Children's Infectious Diseases, Pediatric Surgery	No offers	Take into account Protocol No. 9 of 05/19/2023

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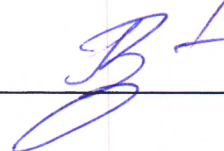
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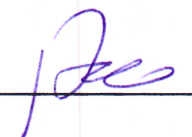
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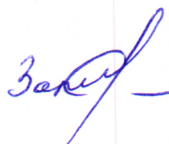
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