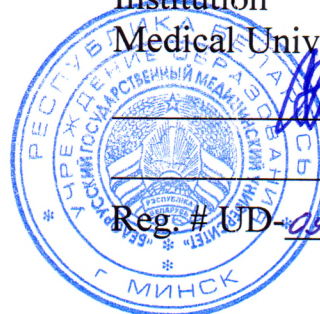
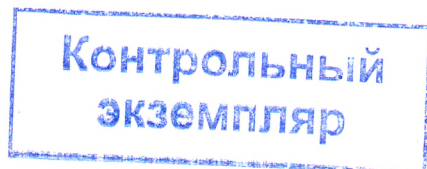


**MINISTRY OF HEALTH OF THE REPUBLIC OF BELARUS**  
Educational Institution  
«BELARUSIAN STATE MEDICAL UNIVERSITY»

**APPROVED**

by Rector of the Educational  
Institution «Belarusian State  
Medical University»

 S.P. Rubnikovich



26.06.2025

Reg. # UJD-0911-01-39/2526/edu.

**PHARMACOLOGY**

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

**7-07-0911-01 «General Medicine»**

Curriculum is based on the educational program «Pharmacology», approved 26.06.2025, registration # УД-0911-01-39/2526/уч; on the educational plan in the specialty 7-07-0911-01 «General Medicine», approved 16.04.2025, registration # 7-07-0911-01/2526/mf.

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### **RECOMMENDED FOR APPROVAL:**

by the Department of Pharmacology of the Educational Institution «Belarusian State Medical University»  
(protocol # 8 of 17.04.2025);

by the Scientific and Methodological Council of the Educational Institution «Belarusian State Medical University»  
(protocol # 10 of 26.06.2025)

## EXPLANATORY NOTE

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

The aim of the academic discipline «Pharmacology» is to develop basic professional competencies for the treatment and prevention of various diseases and the 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 dosing regimen;

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

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

rules for drawing up a doctor's prescription and prescribing medications in various dosage forms;

skills and abilities necessary for:

the use of drugs to provide first aid in case of accidents, injuries, bleeding, poisoning and other conditions that threaten human life and health;

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

### **Relations to other educational disciplines**

Knowledge, skills, abilities obtained during the study of the academic discipline «Pharmacology», are necessary for successful study of the following academic disciplines: «Psychiatry and Narcology», «Internal Diseases», «Clinical Pharmacology» and modules: «Therapy Module 2», «Surgical Module 2», «Therapy Module 3», «Surgical Module 3», «Obstetrics and Gynecology Module», «Pediatric Module».

A student who has mastered the content of the educational material of the academic discipline should have the following basic professional competence: use knowledge about the pharmacological properties of medicines, master the principles of choosing rational pharmacotherapy to treat and prevent diseases and pathological conditions of the human body.

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

**know:**

nomenclature of drugs (medicinal products);

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

the basics of pharmacokinetics and pharmacodynamics of drugs, as well as the specifics of drug use depending on the patient's age;

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 in case of drug poisoning;

problems of drug allergy, 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:**

select the route of administration of the drug and its dosage regimen based on the goals of pharmacotherapy, the 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 for medications based on pharmacokinetic data and the individual characteristics of the patient's body;

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

skills in writing a doctor's prescription for prescribing medications in various dosage forms.

**Total number** of hours for the study of the discipline is 246 academic hours, of which 153 classroom hours and 93 hours of student independent work. Classroom hours according to the types of studies: lectures – 48 hours (including 15 hours of supervised student independent work (SSIW)), practical classes – 105 hours).

Intermediate assessment is carried out in accordance with the curriculum for the specialty in the form of a credit (5th semester) and an examination (6th semester).

Form of higher education is full-time.

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

Code, name of the specialty	Semester	Total number of academic hours	Number of hours of classes				out-of-class self-studies	Form of intermediate assessment
			Number of classroom hours	including		practicals		
				class	SSIW			
7-07-0911-01 «General Medicine»	5	126	81	18	6	57	45	Credit
	6	120	72	15	9	48	48	Examination
<b>Total hours</b>		<b>246</b>	<b>153</b>	<b>33</b>	<b>15</b>	<b>105</b>	<b>93</b>	

## THEMATIC PLAN

Section (topic) name	Number of class hours	
	lectures (incl. SSIW)	practical
<b>1. Introduction to the academic discipline «Pharmacology».</b> <b>General prescription</b>	<b>1,5</b>	<b>9</b>
1.1. The subject of pharmacology. Terminology. Sources and stages of drug development. Legislation in the field of drugs	1,5	1
1.2. General prescription	-	8
<b>2. Pharmacokinetics of drugs</b>	<b>3</b>	<b>9</b>
2.1. Fundamentals of pharmacokinetics	1,5	3
2.2. Principles of drug dosing	1,5	6
<b>3. Pharmacodynamics of drugs</b>	<b>3</b>	<b>6</b>
<b>4. Drugs affecting the peripheral nervous system</b>	<b>4,5</b>	<b>9</b>
4.1. Cholinergic drugs	1,5	3
4.2. Adrenergic drugs. Drugs affecting afferent transmission of nerve impulses	3	6
<b>5. Drugs affecting the cardiovascular system and renal function</b>	<b>9</b>	<b>18</b>
5.1. Diuretics and other drugs affecting the function of the urinary system	1,5	3
5.2. Antihypertensive agents and other agents regulating systemic arterial pressure	1,5	3
5.3. Antianginal agents. Agents for the correction of local blood flow disorders. Hypolipidemic agents	3	6
5.4. Drugs for the treatment of heart failure. Cardiotoxic drugs	1,5	3
5.5. Antiarrhythmic drugs	1,5	3
<b>6. Drugs, affecting the blood system</b>	<b>3</b>	<b>6</b>
<b>7. Drugs, affecting the central nervous system</b>	<b>6</b>	<b>12</b>
7.1. General anesthetics. Ethyl alcohol. Anticonvulsants and antiparkinsonian agents	1,5	3
7.2. Analgesics	1,5	3
7.3. Anxiolytic and sedative-hypnogenic agents. Antipsychotic agents	1,5	3
7.4. Antidepressants, normothymic, nootropic, psychostimulant, analeptic drugs	1,5	3
<b>8. Drugs, regulating tissue metabolism</b>	<b>4,5</b>	<b>12</b>
8.1. Hormonal and antihormonal agents. Agents affecting the tone and contractile activity of the myometrium	1,5	6
8.2. Anti-inflammatory and anti-gout agents	1,5	3
8.3. Antiallergic agents. Immunomodulators. Vitamins and vitamin-like agents	1,5	3
<b>9. Chemotherapeutic drugs</b>	<b>9</b>	<b>15</b>
9.1. Concept of chemotherapy. Principles of action of antibacterial agents. Antiseptics and disinfectants	1,5	3
9.2. Antibiotics	1,5	3

Section (topic) name	Number of class hours	
	lectures (incl. SSIW)	practical
9.3. Synthetic antimicrobial agents. Antimycobacterial agents	1,5	3
9.4. Antiviral and antifungal agents	1,5	2
9.5. Antiprotozoal and antiparasitic agents	1,5	4
9.6. Anti-tumor agents	1,5	-
<b>10. Drugs, affecting respiratory function</b>	<b>1,5</b>	<b>3</b>
<b>11. Drugs, affecting the functions of the digestive organs</b>	<b>3</b>	<b>3</b>
<b>12. Drug-to-drug interactions. Antidotes and principles of medical care for acute drug poisoning</b>	<b>-</b>	<b>3</b>
<b>Total hours</b>	<b>48</b>	<b>105</b>

## CONTENT OF THE EDUCATIONAL DISCIPLINE

### 1. Introduction to the academic discipline «Pharmacology». General prescription

#### 1.1. The subject of pharmacology. Terminology. Sources and stages of drug development. Legislation in the field of drugs

The concept of treatment, the main treatment factors and methods of treatment. The essence of pharmacology as a science of managing the body's vital processes using chemicals. The purpose and objectives of pharmacology. The historical stages of the development of pharmacology as a science, the contributions of Russian scientists to its development. Branches and areas of pharmacology. Clinical pharmacology. Pharmacy.

The concepts of medicinal substance, medicinal product, dosage form and medicinal preparation. Nomenclature of medicinal products. Sources of medicinal substances, stages of drug development and testing. Benefits and risks of medicinal use. Bioethical issues in pharmacology and pharmacotherapy. The Declaration of Helsinki of the World Medical Association, ethical principles for medical research involving human subjects. Control of authorized bodies and organizations over the circulation of medicinal products. Legislation in the field of circulation of medicinal products.

#### 1.2. General prescription

The State Pharmacopoeia, its contents and purpose. International Pharmacopoeia. Pharmacy. Rules for the storage and dispensing of medicines. The doctor's prescription and its structure. The procedure for writing a doctor's prescription and creating an electronic doctor's prescription. Prescribing narcotic, toxic and potent drugs.

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

Liquid dosage forms: general characteristics, dosage and prescription guidelines. Solutions for external and internal use. Solvents. Official solutions. Suspensions. Liquid dosage forms derived from herbal medicinal raw materials: galenic and neogalenic preparations; tinctures, infusions, decoctions, infusions, mucus; emulsions;

extracts. Liniments. Mixtures.

General characteristics and requirements for injectable dosage forms. Rules for prescribing injectable forms of factory- and pharmacy-produced forms.

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

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

## **2. Pharmacokinetics of drugs**

### **2.1. Fundamentals of pharmacokinetics**

Drug transport in the body: absorption, distribution, metabolism, excretion; movement of drugs across barriers. Determinants of transport. Aqueous diffusion. Diffusion in lipids. Transport of substances through membranes with variable ionization. Active transport of substances. The main factors influencing drug transport in the body.

Routes of drug administration, their purposes, advantages and disadvantages. Presystemic elimination of drugs. Distribution of drugs in the body: aqueous spaces and cellular compartments; rate and unevenness of drug distribution. Quantitative laws of drug absorption and elimination. Linear and nonlinear pharmacokinetics. Pharmacokinetic models (single-compartment, dual-compartment).

The main pharmacokinetic parameters: bioavailability, distribution volume, clearance, half-life, elimination constant; their essence, principles of determination and quantitative expression, dimensions, relationships and significance for drug dosing.

#### *Biotransformation and elimination of drugs*

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

Clearance as the primary determinant of pharmacokinetics. Renal drug clearance and its components: filtration, active secretion and reabsorption. Factors influencing renal clearance. Hepatic drug clearance – metabolic transformation and secretion into bile. Key properties of substances excreted in bile. Factors modifying drug clearance.

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

Medication dosing goals and variables: dose, dose types, routes and intervals of administration. Loading dose: therapeutic implications, calculating an individual loading dose based on pharmacokinetic parameters. Conditions and limitations of loading dose use.

Maintenance doses: therapeutic meaning, calculation of maintenance doses to ensure an optimal dosing regimen.

Administration 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 administration rate. Steady-state drug concentration in the blood ( $C_{SS}$ ), the time to achieve it and calculation and management of  $C_{SS}$ .

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

*Correction of the dosage regimen of drugs in various physiological and pathological conditions*

Individual differences in drug distribution and metabolism. Diseases affecting drug pharmacokinetics. Individualized pharmacotherapy strategies aimed at maintaining therapeutic drug concentrations in the blood. Adjustments for calculating individual distribution volumes based on age, gender, body weight, overweight (obesity), fluid sequestration and dehydration.

Principles of adjusting drug dosage regimens for liver and kidney diseases (general approaches). Dosage adjustments based on total drug clearance; preferred options. Dosage adjustments based on residual renal function, liver damage and other pathological conditions, as well as 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 intrinsic activity of drugs. Interactions of drugs with targets: receptor agonism (complete, partial, inverse), receptor antagonism (competitive, non-competitive), non-specific mechanisms of drug action. Terms and concepts of quantitative pharmacology – effect, efficacy, activity. Quantitative laws of drug action. The law of diminishing response of biological systems. General form of the dose-response relationship in normal and lognormal coordinates.

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

Dose types: minimum, average and maximum therapeutic doses; single, daily and course doses; introductory and maintenance doses; toxic doses. Drug safety assessment. Therapeutic index and standard safety limits.

Factors contributing to the therapeutic, adverse and toxic effects of drugs. Adverse drug reactions and side effects: types, nature from the perspective of drug polytropism and pleiotropy, clinical significance; strategies for preventing and managing adverse drug reactions. The impact of drugs on the fetus and the course of pregnancy, including concepts of embryotoxic, teratogenic and fetotoxic effects.

Drug interactions and their types. Drug synergism, additive effects and potentiation of effects. Synergistic drug combinations as the basis of modern pharmacotherapy. Drug antagonism, its types and clinical significance.

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

### **4.1. Cholinergic drugs**

General structure, neurotransmitters and receptors of the peripheral (somatic and autonomic) nervous system. Cholinergic signal transmission. Structure of cholinergic synapses and the mechanism of nerve impulse transmission. 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 system; use, side effects.

N-cholinomimetics: nicotine, cytisine, varenicline. Effects of stimulation of N-cholinoreceptors in the carotid sinus area and chromaffin cells of the adrenal medulla. Nicotinism. Use of nicotinomimetics for smoking cessation.

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

Anticholinesterase agents. Reversible cholinesterase inhibitors: neostigmine, pyridostigmine, physostigmine, donepezil, rivastigmine. Irreversible cholinesterase inhibitors: organophosphorus compounds: ethyl nitrophenyl ethylphosphonate (armine), insecticides (malathion), chemical warfare agents. Pharmacological effects, side effects and toxic effects of anticholinesterase agents; medical care for poisoning: cholinesterase reactivators (pralidoxime), anticholinergics (atropine). Acetylcholine release stimulants (itopride).

#### *Anticholinergic agents*

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

Anticholinergics: atropine, hyoscine butylbromide, ipratropium bromide, tiotropium bromide, tropicamide, darifenacin, oxybutynin, solifenacin. The effects of anticholinergics on the eye, smooth muscles of internal organs, glandular secretion, cardiovascular system and central nervous system. Comparative characteristics of anticholinergics, their use and side effects. First aid for anticholinergic poisoning.

Ganglionic blockers ( $N_N$  - anticholinergics): hexamethonium benzosulfonate. Therapeutic and side effects of ganglionic blockers.

Neuromuscular blocking agents (NMBAs): mivacurium, cisatracurium, vecuronium, rocuronium, suxamethonium chloride. Classification, mechanisms of muscle relaxant action, use, side effects and pharmacological antagonists of NMBAs.

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

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

Adrenergic signaling. The structure of adrenergic synapses and the mechanism of nerve impulse transmission. Regulation of neurotransmitter release, 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)*

$\alpha$ -Adrenergic agonists:  $\alpha_1$ -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 various groups of adrenomimetics depending on dose and rate of administration, use, side effects and toxicity.

*Adrenergic blocking agents*

$\alpha$ -Adrenergic blockers:  $\alpha_1$ -adrenergic blockers – doxazosin, terazosin, tamsulosin;  $\alpha_2$ -adrenergic 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;  $\beta_1$ -adrenergic blockers (cardioselective) - metoprolol, bisoprolol, betaxolol, acebutolol, atenolol, nebivolol.

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

Pharmacodynamics and pharmacokinetics of various classes of beta-blockers, their use, side effects and toxic effects. Criteria for selecting beta-blockers include selectivity, intrinsic sympathomimetic activity, additional vasodilatory activity, duration of action and effects on lipid and carbohydrate metabolism.

*Presynaptic agents*

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

*Agents affecting afferent transmission of nerve impulses*

Local anesthetics: procaine, benzocaine, tetracaine, lidocaine, bupivacaine, articaine, ropivacaine. Classification, mechanism of action and use for different types of anesthesia (infiltration, conduction and surface anesthesia). Toxic effects of local anesthetics and how to prevent them.

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

**5. Drugs affecting the cardiovascular system and renal function****5.1. Diuretics and other drugs affecting the function of the urinary system***Diuretics*

Thiazide and thiazide-like agents: 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, rate of onset and duration of effect. Effect of diuretics on ion balance. Criteria for diuretic selection, use and side effects.

*Other agents affecting renal function:* agents that increase renal blood flow and glomerular filtration (dopamine, phenoldopam, xanthines, cardiac glycosides);

antidiuretic hormone agonists (desmopressin); uricosuric agents (sulfapyrazone); combination agents and herbal medicines for the treatment of urolithiasis - principles of action and application.

## **5.2. Antihypertensive agents and other agents regulating systemic arterial pressure**

The main groups of antihypertensive drugs:

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

renin-angiotensin-aldosterone system (RAAS) inhibitors (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, lercanidipine, lacidipine, verapamil, diltiazem);

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

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

Agents that increase systemic arterial pressure (hypertensives): phenylephrine, midodrine; mechanisms of action, routes and methods of administration, side effects.

## **5.3. Antianginal agents. Agents for the correction of local blood flow disorders. Hypolipidemic agents**

*Antianginal drugs:*

$\beta$ -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 drugs: nicorandil, ranolazine, ivabradine, trimetazidine.

Mechanisms of action, pharmacokinetics and side effects of antianginal agents. Myocardial «steal» phenomenon. Withdrawal syndrome. Nitrate tolerance. Current strategies for pharmacotherapy of coronary artery disease (CAD), comparative characteristics of antianginal agents based on their impact on the course and prognosis of CAD and the choice of agents for the relief and prevention of angina attacks.

*Medications 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.

*Medications used for chronic cerebrovascular disorders (cerebral vasodilators)*

include cinnarizine, vinpocetine, nicergoline, nimodipine and Ginkgo biloba preparations (including combinations). Principles of action, therapeutic effects and side effects.

*Erectile dysfunction medications:* 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 (organic nitrates).

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

*Hypolipidemic agents:* statins (atorvastatin, rosuvastatin); microsomal triglyceride transfer protein inhibitors (lomitapide); apoprotein synthesis inhibitors (mipomersen, volanesorsen), proprotein convertase subtilisin-kexin type 9 (PCSK-9) inhibitors – alirocumab, inclisiran; fibrates (gemfibrozil); bile acid sequestrants (colestyramine); cholesterol absorption inhibitors (ezetimibe); nicotinic acid, enduracin; probucol; resmetirom mechanisms of action, use, selection criteria, side effects.

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

Main drugs for the treatment of heart failure (HF):

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

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

diuretics (hydrochlorothiazide, furosemide, torasemide, 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 for chronic heart failure (CHF) and acute heart failure (AHF). Mechanisms of action of HF treatment agents, selection criteria, side effects and limitations of use. Structural determinants of the pharmacological activity of CGs, their effect on contractile and bioelectrical functions of the heart. The nature of CGs' therapeutic action in cardiac decompensation. Application, side effects and toxic effects of CGs, as well as contraindications. Possible causes of digitalis intoxication and medications for their prevention and treatment.

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

Antiarrhythmic drugs used for tachyarrhythmias: procainamide, lidocaine, propafenone, etacizin; propranolol, esmolol, sotalol; amiodarone, dronedarone, ibutilide; verapamil; adenosine.

Antiarrhythmic drugs used for bradyarrhythmia: M-anticholinergics (atropine),  $\beta$ -adrenergic agonists (isoprenaline).

Classification of antiarrhythmic drugs based on their electrophysiological and pharmacological effects on the myocardium and the main mechanisms of their antiarrhythmic action. Comparative characteristics of antiarrhythmic drugs: effects on key cardiac functions (automatism, excitability, conduction, contractility), electrocardiogram, blood pressure, stroke volume and neurovegetative innervation. Indications and contraindications for the use of antiarrhythmic drugs and selection

criteria. Arrhythmogenic and other side effects of antiarrhythmic drugs.

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

### *Drugs affecting hematopoiesis*

Medications used for anemia: ferrous sulfate and other ferrous salts, iron (III) hydroxide polymaltose, cyanocobalamin, folic acid, epoetin alpha and beta, antilymphocyte globulin. Causes of anemia, principles of pharmacotherapy for anemia. Iron poisoning, antidotes (deferoxamine).

Leukopoiesis-stimulating agents: molgramostim, filgrastim, lenograstim, methyluracil. Causes of leukopenia, principles of pharmacotherapy and prevention of leukopenia.

Drugs that suppress hematopoiesis (antineoplastic agents).

### *Agents affecting hemostasis*

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

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

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

Thrombolytic agents: fibrinolysin, 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. Ethyl alcohol. Anticonvulsants and antiparkinsonian agents**

Definition of the term «anesthesia». Inhalational and non-inhalational anesthesia. Stages of anesthesia. Requirements for the ideal general anesthetic drug (GA). Molecular and neurophysiological mechanisms of GA action.

Inhalation GA: halothane, isoflurane, sevoflurane, dinitrogen oxide (nitrous oxide). Concept of inhalation GA activity (minimum alveolar concentration).

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

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

*Ethyl alcohol.* Local and resorptive effects of ethyl alcohol; medical use. Acute ethyl alcohol poisoning, medical care. Chronic ethyl alcohol poisoning (alcoholism): principles and treatment options (disulfiram, apomorphine, acamprosate).

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

*Antispasticity agents:* centrally acting muscle relaxants (baclofen, tizanidine, tolperisone), dantrolene: mechanisms of action, side and toxic effects.

*Antiparkinsonian drugs:* levodopa, amantadine, selegiline, trihexyphenidyl, pramipexole. Use of DOPA decarboxylase inhibitors (carbidopa, benserazide) and COMT inhibitors (entacapone) to reduce side effects and increase the effectiveness of levodopa. Principles of drug therapy for extrapyramidal disorders. Pharmacokinetics of

antiparkinsonian drugs, pharmacological and side effects.

## 7.2. Analgesics

Current concepts of pain perception and regulation systems in the human body. The nociceptive system: specific and nonspecific pain pathways; pain mediators. The antinociceptive system, antinociceptive system mediators 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.

Opioid receptor agonists-antagonists (pentazocine) and partial agonists (buprenorphine).

Opioid antagonists: naloxone, naltrexone.

Molecular and cellular mechanisms of action, primary pharmacological effects and 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 for drug addiction and withdrawal syndrome. Drug interactions of opioids.

*Non-narcotic analgesics* (nefopam, paracetamol, ibuprofen, diclofenac, ketorolac, acetylsalicylic acid, metamizole sodium, combination agents) and mixed-action analgesics (tramadol, tapenadol): mechanisms of analgesic action, use, side effects and contraindications. Comparative characteristics of non-narcotic and narcotic analgesics. Concepts of neuroleptanalgesia and ataralgesia.

*Drugs used for neuropathic pain syndromes*

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

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

## 7.3. Anxiolytic and sedative-hypnogenic agents. Antipsychotic agents

*Anxiolytics (tranquilizers) and sedative-hypnogenic drugs.*

Anxiolytic, sedative and hypnotic effects – their nature, 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 preparations (valerian, motherwort); bromides (sodium bromide); combination agents (corvalol).

Hypnogenic (sleeping) agents: triazolam, nitrazepam, zaleplon, zopiclone, zolpidem, chloral hydrate; melatonin, ramelteon; suvorexant.

Neurophysiological and molecular mechanisms of action of anxiolytic and sedative-hypnogenic agents. Pharmacological, adverse and toxic effects, applications and limitations

of anxiolytic and sedative-hypnogenic agents. Acute benzodiazepine poisoning, benzodiazepine antagonist (flumazenil).

*Antipsychotics (neuroleptics).*

Antipsychotics as a special class of psychopharmacological agents. Concept of neuroplegia. Antipsychotic agents (chlorpromazine, flupentixol, haloperidol, droperidol, clozapine, risperidone, aripiprazole, cariprazine, xanomeline/trospium): 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 agents, features of therapeutic and side effects of atypical antipsychotic agents.

#### **7.4. Antidepressants, normothymic, nootropic, psychostimulant, analeptic drugs**

*Antidepressants (thymoanaleptics)*

Tricyclic antidepressants: imipramine, amitriptyline.

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

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

Selective norepinephrine reuptake inhibitors (maprotiline, reboxetine).

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

Monoamine oxidase inhibitors (moclobemide).

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

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

Nootropic and antidementia drugs: piracetam, vinpocetine, nimodipine, nicergoline, donepezil, memantine, cinnarizine, cortexin; anti-amyloid drugs – donanemab.

Psychostimulants: caffeine, mesocarb, methylphenidate.

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

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

### **8. Drugs, regulating tissue metabolism**

#### **8.1. Hormonal and antihormonal agents. Agents affecting 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.

*Hypothalamus and pituitary hormone preparations*

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

Preparations of hormones of the anterior pituitary gland: somatotropin, gonadotropins (urofollitropin, human chorionic gonadotropin, lutropin alpha, menotropins), thyrotropin.

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

Pituitary hormone antagonists (danazol, bromocriptine).

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

Pineal gland hormone preparations (melatonin and other melatonin receptor agonists): pharmacological activity, use in medicine.

*Thyroid and antithyroid drugs*

Thyroid hormone preparations: sodium levothyroxine (T4), liothyronine (T3), their therapeutic use.

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

*Hormonal drugs of the pancreas 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) and their sources. Dosage principles and routes of administration for insulin preparations, complications of insulin therapy.

Oral hypoglycemic agents (glibenclamide, glicvidone, metformin): mechanism of action, indications for use, side effects. Other antidiabetic agents: insulin sensitizers (pioglitazone), insulin release stimulants (repaglinide), carbohydrate absorption inhibitors (acarbose), incretin mimetics (liraglutide, vildagliptin), renal glucose reabsorption inhibitors (empagliflozin), amylin analogs (pramlintide).

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

*Adrenal cortex hormone preparations*

GCS: hydrocortisone, methylprednisolone, prednisolone, triamcinolone, dexamethasone, betamethasone, fluocinolone. The effect of GCS on human metabolism. Anti-inflammatory and anti-allergic properties of GCS, therapeutic use, side effects. Synthetic GCS for topical use.

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

Corticosteroid synthesis inhibitors (aminoglutethimide, mitotane).

*Female sex hormone preparations*

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

Progestogen drugs: progesterone, dydrogesterone; progestogen receptor modulators – ulipristal.

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

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

Contraceptives (birth control pills): monophasic (Novinet, Regulon), biphasic (Anteovin), triphasic (Tri-regol, Qlayra), norethisterone, levonorgestrel; principles of action, side effects.

*Male sex hormone preparations, anabolic steroids*

Androgenic drugs (testosterone and its esters): pharmacological activity, use, side effects. Antiandrogenic 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 tissue metabolism*

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

*Agents affecting the tone and contractile function of the myometrium*

Agents for intensifying labor (oxytocin, dinoprost); agents for stopping uterine bleeding (ergot preparations, oxytocin), tocolytic agents (hexoprenaline, atosiban): mechanisms of action, pharmacological effects, application.

## **8.2. Anti-inflammatory and anti-gout agents**

GCS: prednisolone, methylprednisolone, triamcinolone, dexamethasone, betamethasone. Mechanisms of action, basic regimens for GCS use, side effects of GCS and how 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 inflammatory mediators and cells, prostaglandin synthesis processes (COX-1 and COX-2), monoamines, kinins, fibroblast proliferation, acid mucopolysaccharide synthesis, transcription factor NF-kB, cartilage metabolism), other pharmacological effects of NSAIDs. Indications and contraindications for the use of NSAIDs, side effects, their prevention.

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

## **8.3. Antiallergic agents. Immunomodulators. Vitamins and vitamin-like agents**

*Medicines used for immediate allergic reactions*

Antihistamines (H1-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-type allergic reactions*

Basic antirheumatic drugs: auranofin, penicillamine, chloroquine, sulfasalazine; and immunosuppressants of 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 (tilorone, arbidol); thymus preparations (thymogen); other immunomodulators: glatiramer acetate, inosine pranobex, herbal preparations (echinacea preparations, including in combinations) - mechanisms of action, use in medicine. Immunosuppressive properties of cytostatic (antineoplastic) agents.

*Vitamins and vitamin-like products*

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

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

Fat-soluble vitamins: retinol, ergocalciferol, alfacalcidol, phytomenadione, tocopherol. Hypervitaminosis with the use of retinol and ergocalciferol.

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

**9. Chemotherapeutic drugs****9.1. Concept of chemotherapy. Principles of action of antibacterial agents.****Antiseptics and disinfectants**

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

The concept of antiseptics and disinfection. The difference between antiseptics and chemotherapeutic agents. Requirements for antiseptics. The main groups of antiseptics:

Aromatic antiseptics:

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

nitrofurans derivatives – nitrofurantoin;

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.

Halogenated compounds:

iodine preparations: iodine alcohol 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 (faringosept); multicomponent agents (virkon).

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

Conditions determining the antimicrobial activity of antiseptics, mechanisms of action of antiseptics of different chemical groups. Specific uses of individual antiseptics. Principles of treating acute antiseptic poisoning.

## 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 drugs of penicillins with  $\beta$ beta-lactamase inhibitors - clavulanic acid, sulbactam, tazobactam, avibactam.

Cephalosporins and cephamycins: cephalexin, cephradine, 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  $\beta\beta$ -lactamases, routes of administration.

Carbapenems (imipenem, meropenem, ertapenem, doripenem).

Monobactams (aztreonam).

Glycopeptides (vancomycin, teicoplanin).

*Antibiotics that disrupt the permeability of the cytoplasmic membrane*

Polypeptides (polymyxin B).

Polynes (nystatin, amphotericin B).

*Antibiotics that inhibit nucleic acid synthesis*

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 activity of antibiotics of various groups, routes of administration, dosing guidelines, side and toxic effects and contraindications. Principles of combination antibiotic therapy.

## 9.3. Synthetic antimicrobial agents. Antimycobacterial agents

Sulfonamide agents: sulfadimidine, sulfadiazine, sulfadimethoxine, sulfalene, phthalylsulfathiazole, sulfacetamide, combinations of sulfonamides with trimethoprim

(co-trimoxazole).

Oxyquinolines (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 (dapson, clofazimine, rifampicin).

Mechanisms of action, pharmacokinetics and adverse reactions of antimycobacterial agents. Primary and secondary antituberculosis agents; principles of tuberculosis pharmacotherapy; concept of tuberculosis chemoprophylaxis.

#### **9.4. Antiviral and antifungal agents**

Anti-influenza drugs: rimantadine, oseltamivir, baloxavir marboxil.

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.

Anti-cytomegalovirus agents (ganciclovir).

Medicines 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.

Medicines 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 combinations of drugs: 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-2 a, interferon alpha-2 b, interferon beta, interferon gamma-1 b) and interferonogens (tilorone, arbidol).

Mechanisms of action, principles of application, 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, quiniofon, doxycycline, chloroquine, paromomycin.

Medicines used for trichomoniasis: tinidazole, metronidazole.

Drugs used for giardiasis (lambliasis): 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 agents, use and side effects. Concept of individual and community-based malaria chemoprophylaxis.

*Antiparasitic (anthelmintic) agents* (mebendazole, pyrantel, albendazole, ivermectin, piperazine adipate, levamisole, praziquantel, niclosamide, bithionol): mechanisms of action, principles of administration, side effects. Agents used for intestinal nematodes, cestode and trematodes: properties, administration and side effects. General characteristics of agents used for extraintestinal helminthiasis.

#### **9.6. Anti-tumor agents**

Principles of chemotherapy for malignant neoplasms. Classification of antitumor agents: alkylating agents (cyclophosphamide, melphalan, busulfan), antimetabolites (methotrexate, fluorouracil, cytarabine, mercaptopurine), agents that disrupt mitosis (vincristine, paclitaxel, etoposide), antibiotics (bleomycin, doxorubicin, mitomycin), enzymes (L-asparaginase), platinum agents (cisplatin). Targeted antitumor agents (imatinib, bevacizumab, bortezomib and others). Targets and mechanisms of action of antitumor agents, tumor cell resistance to antitumor agents and its overcoming, complications of neoplasm chemotherapy and their prevention.

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

*Medications for the treatment of bronchial asthma and relief of bronchospasm:*  $\beta$ -adrenergic agonists (salbutamol, salmeterol, formoterol), glucocorticosteroids (beclomethasone, budesonide), allergy mediator release inhibitors (cromoglycic acid, ketotifen), M-anticholinergics (ipratropium, tiotropium), leukotriene receptor antagonists (montelukast), phosphodiesterase inhibitors (aminophylline, theophylline and prolonged forms), immunoglobulin E inhibitors (omalizumab). Choice of drugs for the pharmacotherapy of bronchial asthma, relief and prevention of asthma attacks.

*Respiratory stimulants:* almitrine, doxapram, bemegride, ethimizole, nikethamide.

*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 alpha.

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

Principles of action of different groups of drugs that affect respiratory function,

use, 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 medications used to correct gastrointestinal dysfunction. Main classes of medications, mechanisms of action, pharmacological and side effects and applications.

#### *Remedies for the treatment of gastric 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.

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

Selective M<sub>1</sub>-anticholinergics (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, levofloxacin.

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

Motility inhibitors: anticholinergics (dicycloverine, atropine); myotropic and mixed action antispasmodics (drotaverine, pinaverium bromide).

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

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

Laxatives: senna preparations, bisacodyl, magnesium sulfate, lactulose, methylcellulose and mineral oil. Localization of action and speed of onset of 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 depends on the cause and mechanism of vomiting.

#### *Hepatotropic agents*

Choleretic agents: dehydrocholic acid, osalmide, magnesium sulfate, drotaverine, M-anticholinergics, herbal medicines.

Cholelithiatic agents (ursodeoxycholic acid).

Hepatoprotectors: betaine, ademetionine, essentielle.

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

#### *Agents that affect appetite and digestion processes*

Antianorexic agents (appetite enhancers): wormwood tincture,

cyproheptadine.

Anorexigenic agents: phenylpropanolamine, dexfenfluramine. Limitations and risks of use, side effects of anorexigenic agents.

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

Antiobesity medications: anorexigenic agents, intestinal lipase inhibitors (orlistat), agents that create a satiety effect (methylcellulose), hypoglycemic agents (metformin, acarbose).

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

Concomitant administration 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 toxicity and hazard. Toxicokinetics and toxicodynamics. Primary mechanisms of toxic action. Principles and means of medical care for acute drug poisoning. Main groups of antidotes: toxicotropic, toxicokinetic, pharmacological antagonists and immunological antidotes (antitoxic serums). Mechanisms of action of antidotes, conditions and limitations of their use. Prevention of acute drug poisoning.

### ACADEMIC DISCIPLINE «PHARMACOLOGY» CURRICULAR CHART

Section, topic #	Section (topic) name	Number of class hours		SSIW	Literature	Practical skill	Forms of control	
		lectures	practical				of practical skill	of current / intermediate assessment
<b>5th semester</b>								
	<b>Lectures</b>	<b>18</b>	<b>-</b>	<b>6</b>				
1.	The subject of pharmacology. Terminology. Sources and stages of drug development. Legislation in the field of drugs	1,5	-	-				
2.	Fundamentals of Pharmacokinetics	1,5	-	-				
3.	Principles of drug dosing	1,5	-	-				
4.	Pharmacodynamics of drugs	1,5	-	-				
5.	Features of pharmacokinetics and pharmacodynamics of drugs based on monoclonal antibodies	-	-	1,5	1, 2, 16, 20			Testing, interview
6.	Cholinergic drugs	1,5	-	-				
7.	Adrenergic drugs	1,5	-	-				
8.	Drugs affecting afferent transmission of nerve impulses	-	-	1,5	1, 2, 16, 20			Testing, interview
9.	Diuretics and other drugs affecting the function of the urinary system	-	-	1,5	1, 2, 16, 20			Testing, interview
10.	Antihypertensive agents and other agents regulating systemic arterial pressure	1,5	-	-				
11.	Antianginal agents. Agents for the correction of local blood flow disorders	1,5	-	-				
12.	Hypolipidemic agents	-	-	1,5	1, 2, 16, 20			Testing

13.	Drugs for the treatment of heart failure. Cardiotonic drugs	1,5	-	-				
14.	Antiarrhythmic drugs	1,5	-	-				
15.	Drugs affecting the blood system. Drugs affecting hematopoiesis	1,5	-	-				
16.	Drugs affecting the blood system. Drugs affecting hemostasis	1,5	-	-				
	<b>Practical classes</b>	-	<b>57</b>	-				
1.	Pharmacology. Terminology. Sources and stages of drug development. Legislation in the field of drugs. General prescription. Rules of writing out doctor's prescriptions for drugs in various dosage forms. Solid dosage forms	-	3	-	1, 2, 4, 16, 17, 18, 19, 20	Writing a doctor's prescription and creating an electronic doctor's prescription when prescribing medications in various dosage forms	Writing a doctor's prescription	Checking written prescriptions
2.	General prescription guidelines. Rules of writing out doctor's prescriptions for medications in various dosage forms. Liquid dosage forms	-	3	-	1, 2, 4, 16, 17, 18, 19, 20	Writing a doctor's prescription and creating an electronic doctor's prescription when prescribing medications in various dosage forms	Writing a doctor's prescription	Checking written prescriptions
3.	General prescription. Rules of writing out doctor's prescriptions for medications in various dosage forms. Injectable dosage forms. Soft dosage forms	-	3	-	1, 2, 4, 16, 17, 18, 19, 20	Writing a doctor's prescription and creating an electronic doctor's prescription when prescribing medications in various dosage forms	Writing a doctor's prescription	Checking written recipes
4.	Fundamentals of Pharmacokinetics	-	3	-	1, 2, 5, 16, 20			Testing
5.	Principles of drug dosing	-	3	-	1, 2, 5, 16, 20			Testing
6.	Calculation of the dosage regimen of drugs for various physiological and pathological conditions	-	3	-	1, 2, 5, 16, 20	Calculation of an individual dosage regimen for pathological conditions that alter the clearance and volume of distribution of drugs	Solving a situational problem	Testing
7.	Pharmacodynamics of drugs	-	3	-	1, 2, 5, 16, 20			Survey, testing
8.	Final lesson on the topics: «General Prescription», «Pharmacokinetics of	-	3	-	1, 2, 4, 5, 16,	1. Writing a doctor's prescription and creating an electronic doctor's	Writing a doctor's prescription*, solving a	Written control work*

	drugs», «Pharmacodynamics of drugs»				17, 18, 19, 20	prescription when prescribing medications in various dosage forms. 2. Calculation of an individual dosage regimen for pathological conditions that alter the clearance and volume of distribution of drugs	situational problem*	
9.	Cholinergic drugs	-	3	-	1, 2, 3, 5, 16, 20	1. Working with electronic information databases and reference guides on medicines. 2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	Writing a doctor's prescription, solving a situational problem	Testing, checking written prescriptions
10.	Adrenergic drugs. Adrenergic agonists	-	3	-	1, 2, 3, 5, 16, 20	1. Working with electronic information databases and reference guides on medicines. 2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	Writing a doctor's prescription, solving a situational problem	Testing, checking written prescriptions
11.	Adrenergic antagonists. Drugs affecting afferent transmission of nerve impulses.	-	3	-	1, 2, 3, 5, 16, 20	1. Working with electronic information databases and reference guides on medicines. 2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	Writing a doctor's prescription, solving a situational problem	Testing, checking written prescriptions
12.	Diuretics and other drugs affecting the function of the urinary system	-	3	-	1, 2, 5, 12, 16, 20	1. Working with electronic information databases and reference guides on medicines. 2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic	Writing a doctor's prescription, solving a situational problem	Testing, checking written prescriptions

						data of the drug and the goals of pharmacotherapy		
13.	Antihypertensive agents and other agents regulating systemic arterial pressure	-	3	-	1, 2, 3, 5, 8, 12, 16, 20	1. Working with electronic information databases and reference guides on medicines. 2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	Writing a doctor's prescription, solving a situational problem	Testing, checking written prescriptions
14.	Antianginal agents. Agents for the correction of local blood flow disorders. Hypolipidemic agents	-	3	-	1, 2, 5, 16, 20	1. Working with electronic information databases and reference guides on medicines. 2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	Writing a doctor's prescription, solving a situational problem	Testing, checking written prescriptions
15.	Drugs for the treatment of heart failure. Cardiotonic drugs	-	3	-	1, 2, 5, 16, 20	1. Working with electronic information databases and reference guides on medicines. 2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	Writing a doctor's prescription, solving a situational problem	Testing, checking written prescriptions
16.	Antiarrhythmic drugs	-	3	-	1, 2, 5, 16, 20	1. Working with electronic information databases and reference guides on medicines. 2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	Writing a doctor's prescription, solving a situational problem	Testing, checking written prescriptions

17.	Final lesson on the topics: «Drugs affecting the peripheral nervous system» and «Drugs affecting the cardiovascular system and renal function»	-	3	-	1, 2, 5, 6, 7, 9, 12, 16, 20	1. Working with electronic information databases and reference guides on medicines. 2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	Writing a doctor's prescription*, solving a situational problem*	Testing*, written control work*
18.	Drugs affecting hematopoiesis	-	3	-	1, 2, 3, 5, 8, 16, 20	1. Working with electronic information databases and reference guides on medicines. 2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	Writing a doctor's prescription, solving a situational problem	Testing, checking written prescriptions
19.	Drugs affecting hemostasis	-	3	-	1, 2, 3, 5, 8, 16, 20	1. Working with electronic information databases and reference guides on medicines. 2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	Writing a doctor's prescription, solving a situational problem	Testing, checking written prescriptions

## 6th semester

	<b>Lectures</b>	<b>15</b>	<b>-</b>	<b>9</b>				
1.	Anticonvulsants. Drugs for the treatment of neurodegenerative diseases. Regulators of brain blood flow. Nootropic drugs	-	-	1,5	1, 2, 16, 20			Testing, interview
2.	Analgesics	-	-	1,5	1, 2, 16, 20			Testing, interview
3.	Anxiolytics and sedative-hypnogenic agents. Antipsychotics	1,5	-	-				

4.	Antidepressants, normothymic, nootropic, psychostimulant, analeptic drugs	1,5	-	-			
5.	Hormonal and antihormonal agents	1,5	-	-			
6.	Anti-inflammatory and anti-allergic agents	1,5	-	-			
7.	Anti-gout, anti-rheumatic agents. Immunomodulatory agents	1,5	-	-			
8.	The concept of chemotherapy. Principles of action of antibacterial agents. Antiseptics and disinfectants. $\beta$ -lactam and other antibiotics that inhibit cell wall synthesis	1,5	-	-			
9.	Antibiotics that disrupt cytoplasmic membrane permeability. Antibiotics that inhibit nucleic acid synthesis. Antibiotics that inhibit protein synthesis	1,5	-	-			
10.	Antiviral agents. Antifungal agents	1,5	-	-			
11.	Synthetic antimicrobial agents. Anti-tuberculosis agents	-	-	1,5	1, 2, 16, 20		Testing, interview
12.	Antiprotozoal and antiparasitic agents	-	-	1,5	1, 2, 16, 20		Testing, interview
13.	Anti-tumor agents	1,5	-	-			
14.	Drugs affecting the functions of the digestive organs. Medications for the treatment of gastric and duodenal ulcers. Medications affecting gastrointestinal tone and motility	1,5	-	-			
15.	Emetics and antiemetics. Hepatotropic agents. Agents affecting pancreatic function. Agents affecting appetite and digestion	-	-	1,5	1, 2, 16, 20		Testing, interview
16.	Drugs affecting respiratory function	-	-	1,5	1, 2, 16, 20		Testing, interview

	<b>Practical classes</b>	-	<b>48</b>	-				
1.	General anesthetics. Ethyl alcohol. Anticonvulsants and antiparkinsonian agents	-	3	-	1, 2, 5, 16, 20	1. Working with electronic information databases and reference guides on medicines. 2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	Writing a doctor's prescription, solving a situational problem	Testing, checking written prescriptions
2.	Analgesics	-	3	-	1, 2, 5, 16, 20	1. Working with electronic information databases and reference guides on medicines. 2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	Writing a doctor's prescription, solving a situational problem	Testing, checking written prescriptions
3.	Anxiolytics and sedative-hypnogenic agents. Antipsychotics	-	3	-	1, 2, 5, 16, 20	1. Working with electronic information databases and reference guides on medicines. 2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	Writing a doctor's prescription, solving a situational problem	Testing, checking written prescriptions
4.	Antidepressants, normothymic, nootropic, psychostimulant, analeptic drugs	-	3	-	1, 2, 5, 16, 20	1. Working with electronic information databases and reference guides on medicines. 2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	Writing a doctor's prescription, solving a situational problem	Testing, checking written prescriptions
5.	Hormonal and antihormonal agents. Hypothalamic and pituitary hormone preparations. Thyroid and antithyroid	-	3	-	1, 2, 5, 16, 20	1. Working with electronic information databases and reference guides on medicines.	Writing a doctor's prescription,	Testing, checking written prescriptions

	agents. Pancreatic hormonal preparations and synthetic antidiabetic agents. Adrenal cortex hormone preparations. Female sex hormone preparations. Male sex hormone preparations, anabolic steroids. Hormonal regulators of mineral homeostasis and other agents affecting bone metabolism. Agents affecting the tone and contractility of the myometrium					2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	solving a situational problem	
6.	Anti-inflammatory and anti-gout drugs	-	3	-	1, 2, 5, 16, 20	1. Working with electronic information databases and reference guides on medicines. 2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	Writing a doctor's prescription, solving a situational problem	Testing, checking written prescriptions
7.	Antiallergic agents. Immunomodulators. Vitamins and vitamin-like agents	-	3	-	1, 2, 5, 16, 20	1. Working with electronic information databases and reference guides on medicines. 2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	Writing a doctor's prescription, solving a situational problem	Testing, checking written prescriptions
8.	Final lesson on the topics: «Drugs affecting the central nervous system» and «Drugs regulating tissue metabolism»	-	3	-	1, 2, 5, 6, 7, 9, 10, 11, 16, 20	1. Working with electronic information databases and reference guides on medicines. 2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	Writing a doctor's prescription*, solving a situational problem*	Testing*, written control work*

9.	Concept of chemotherapy. Principles of action of antibacterial agents. Antiseptics and disinfectants	-	3	-	1, 2, 5, 16, 20	1. Working with electronic information databases and reference guides on medicines. 2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	Writing a doctor's prescription, solving a situational problem	Testing, checking written prescriptions
10.	Antibiotics	-	3	-	1, 2, 5, 16, 20	1. Working with electronic information databases and reference guides on medicines. 2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	Writing a doctor's prescription, solving a situational problem	Testing, checking written prescriptions
11.	Synthetic antimicrobial agents. Antimycobacterial agents	-	3	-	1, 2, 5, 16, 20	1. Working with electronic information databases and reference guides on medicines. 2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	Writing a doctor's prescription, solving a situational problem	Testing, checking written prescriptions
12.	Antiviral and antifungal agents. Antiprotozoal and antiparasitic agents	-	3	-	1, 2, 5, 16, 20	1. Working with electronic information databases and reference guides on medicines. 2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	Writing a doctor's prescription, solving a situational problem	Testing, checking written prescriptions
13.	Final lesson on the topic: «Chemotherapeutic drugs»	-	3	-	1, 2, 5, 6, 7, 9, 16, 20	1. Working with electronic information databases and reference guides on medicines.	Writing a doctor's prescription*, solving a situational problem*	Testing*, written control work*

						2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy		
14.	Drugs affecting respiratory function	-	3	-	1, 2, 3, 5, 8, 16, 20	1. Working with electronic information databases and reference guides on medicines. 2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	Writing a doctor's prescription, solving a situational problem	Testing, checking written prescriptions
15.	Drugs affecting the functions of the digestive organs	-	3	-	1, 2, 3, 5, 8, 16, 20	1. Working with electronic information databases and reference guides on medicines. 2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	Writing a doctor's prescription, solving a situational problem	Testing, checking written prescriptions
16.	Drug-to-drug Interactions: Antidotes and Principles of Medical Care for Acute Drug Poisoning	-	3	-	1, 2, 5, 6, 7, 9, 16, 20	1. Working with electronic information databases and reference guides on medicines. 2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	Writing a doctor's prescription, solving a situational problem	Testing, checking written prescriptions
	<b>Total hours</b>	<b>33</b>	<b>105</b>	<b>15</b>				Examination

\* This is a mandatory form of current certification

## INFORMATION AND INSTRUCTIONAL UNIT

### LITERATURE

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

1. Kharkevitch, D. A. Pharmacology : textbook for medical students.– 2nd ed., rev.and suppl. – Moscow : GEOTAR-Media Publishing Group, 2017. – 680 p.
2. Essentials of pharmacology : textbook for foreign students of higher education institutions in the specialty «General Medicine», «Pediatrics» / V. I. Kozlovsky [et al]. – Minsk : Higher School, 2019. – 287 p.

#### **Additional**

3. Vauchok, A. U. Pharmacology Tests for the specialty «General Medicine» / A. U. Vauchok, N. A. Bizunok, B. V. Dubovik, A. V. Shaluhina. – Minsk : BSMU, 2025. – 107 p.
4. Vanderah, T. W. Basic and Clinical Pharmacology – 16th ed. – New York : McGraw-Hill Medical, 2023. – 1368 p.
5. Katzung & Trevor's Pharmacology Examination and Board Review / M. Knuidering-Hall [et al]. – 14th ed. – New York : McGraw-Hill Medical, 2024. – 624 p.
6. Brunton, L. Goodman & Gilman's The Pharmacological basis of Therapeutics / L. Brunton, B. Knollman. – 14th ed. – McGraw-Hill, 2022. – 1664 p.
7. Ford, S. M. Introductory Clinical Pharmacology – 12th ed. – Lippincott Williams & Wilkins, 2021. – 736 p.
8. Brenner, G. M. Brenner and Stevens' Pharmacology / G. M. Brenner, C. M. Stevens. – 6th ed. – Philadelphia : Saunders Elsevier, 2023. – 610 p.
9. Rang and Dale's Pharmacology / Ritter, James M. [et al.]. – 10th ed. – Edinburgh : Elsevier, Churchill Livingstone, 2024. – 872 p.
10. Wecker, L. Brody's Human Pharmacology / Lynn Wecker, Susan L. Ingram eds. Molecular to Clinical. – 7th ed. – Elsevier, 2024. – 800 p.
11. Gardenhire, D. S. Rau's Respiratory Care Pharmacology. – 11th ed. – Saint Louis : Mosby, 2024. – 464 p.
12. Whalen, C. Lippincott Illustrated Reviews: Pharmacology – 8th ed. – Lippincott Williams & Wilkins, 2022. – 704 p.
13. AHFS Drug Information. – American Society of Health-System Pharmacists, 2022. – 3746 p.
14. Briggs, G. G. Drugs in Pregnancy & Lactation : A Reference Guide to Fetal and Neonatal Risk / G. G. Briggs, C. V. Towers, A. B. Forinash. – 12th ed. – Philadelphia : Lippincott Williams & Wilkins, 2021. – 1446 p.
15. PDRnet : [Fully Searchable Drug Information], 2025. – URL: <https://www.pdr.net> (date of access: 24.12.2025).
16. Preston, C. L. Stockley's drug interactions : a source book of interactions, their mechanisms, clinical importance and management. – 12th ed. – London : Pharmaceutical Press, 2019. – 2040 p.

#### **Normative legal acts**

17. On Medicines : Law of the Republic of Belarus dated 19.07.2006 # 161-Z.
18. On narcotic drugs, psychotropic substances, their precursors and analogues : Law of the Republic of Belarus dated 12.07.2012 # 408-Z.

19. Instructions on the procedure for issuing a doctor's prescription : Resolution of the Ministry of Health of the Republic of Belarus dated October 31.10.2007 # 99.

**Electronic courseware for the academic discipline «Pharmacology»:**

20. <https://etest.bsmu.by/course/view.php?id=311>.

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

The time allocated for independent work can be used by students to:  
 preparation for lectures and practical classes;  
 preparation for control works 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**

##### **APPROXIMATE LIST OF TASKS FOR SUPERVISED STUDENT INDEPENDENT WORK:**

writing and presentation of an abstract;  
 presentation of a report;  
 study of topics and problems that are not covered in lectures;  
 taking notes from primary sources (sections of anthologies, collections of documents, monographs, textbooks);  
 computer testing.

##### **FORMS OF CONTROL OF GUIDED INDEPENDENT WORK:**

testing;  
 control work;  
 discussion of abstracts.

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

The following forms are used to diagnose competencies:

control work;  
 written control work;  
 checking written prescriptions;  
 testing;  
 interview.

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

Traditional method;  
 active (interactive) methods:

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

#### LIST OF PRACTICAL SKILLS

Name of practical skill	Form of practical skills control
1. Working with electronic information databases and reference guides on medicines	Writing a doctor's prescription
2. Selection of the route of administration of the drug, its dosage regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy	Solving a situational problem
3. Calculation of an individual dosage regimen for pathological conditions that alter the clearance and volume of distribution of drugs	Solving a situational problem, writing a doctor's prescription
4. Writing a doctor's prescription and creating an electronic doctor's prescription when prescribing medications in various dosage forms	Writing a doctor's prescription

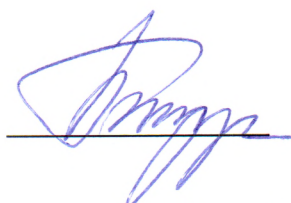
### PROTOCOL OF CURRICULUM APPROVAL

Title of the discipline requiring approval	Department	Amendments to the curriculum in the academic discipline	Title of the discipline requiring approval
Internal Diseases	Internal Diseases, Cardiology and Rheumatology with a course of advanced training and retraining	No offers	Take into account. Protocol # 8 of 17.04.2025
Psychiatry and Narcology	Psychiatry and Medical Psychology with a course of advanced training and retraining	No offers	Take into account. Protocol # 8 of 17.04.2025
Dermatovenereology	Dermatovenereology and cosmetology with a course of advanced training and retraining	No offers	Take into account. Protocol # 8 of 17.04.2025
Phthisiopulmonology	Phthisiopulmonology with a course of advanced training and retraining	No offers	Take into account. Protocol # 8 of 17.04.2025
Neurology and Neurosurgery	Nervous and Neurosurgical Diseases	No offers	Take into account. Protocol # 8 of 17.04.2025
Outpatient Therapy	Outpatient Therapy	No offers	Take into account. Protocol # 8 of 17.04.2025
Otorhinolaryngology and Dentistry	Otolaryngology with a course of retraining and advanced training	No offers	Take into account. Protocol # 8 of 17.04.2025
Ophthalmology	Eye Diseases	No offers	Take into account. Protocol # 8 of 17.04.2025
Anesthesiology and Reanimatology	Anesthesiology and Reanimatology with a course of retraining and advanced training	No offers	Take into account. Protocol # 8 of 17.04.2025
Clinical Pharmacology	Clinical Pharmacology	No offers	Take into account. Protocol # 8 of 17.04.2025
Infectious Diseases	Infectious Diseases with an advanced training course and retraining courses	No offers	Take into account. Protocol # 8 of 17.04.2025
Endocrinology	Endocrinology	No offers	Take into account. Protocol # 8 of 17.04.2025
Medical Rehabilitation and Physiotherapy	Medical Rehabilitation and and Sports Medicine with an advanced training course and retraining courses	No offers	Take into account. Protocol # 8 of 17.04.2025
Surgical Diseases	Surgical Diseases with an advanced training course and retraining courses	No offers	Take into account. Protocol # 8 of 17.04.2025

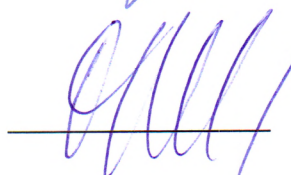
Oncology	Oncology with an advanced training course and retraining courses	No offers	Take into account. Protocol # 8 of 17.04.2025
Traumatology and Orthopedics	Traumatology and Orthopedics with an advanced training course and retraining courses	No offers	Take into account. Protocol # 8 of 17.04.2025
Urology	Urology and Nephrology with an advanced training course and retraining courses	No offers	Take into account. Protocol # 8 of 17.04.2025
Obstetrics and gynecology	Obstetrics and Gynecology with an advanced training course and retraining courses	No offers	Take into account. Protocol # 8 of 17.04.2025
Pediatrics	1st of Childhood Diseases, 2nd of Childhood Diseases	No offers	Take into account. Protocol # 8 of 17.04.2025
Pediatric Infectious Diseases	Childhood Infectious Diseases with a course of advanced training and retraining	No offers	Take into account. Protocol # 8 of 17.04.2025
Pediatric Surgery	Pediatric Surgery with a course of advanced training and retraining	No offers	Take into account. Protocol #8 of 17.04.2025

**COMPILERS/AUTHORS:**

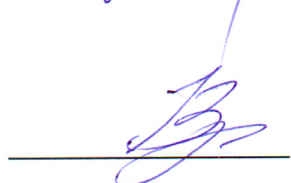
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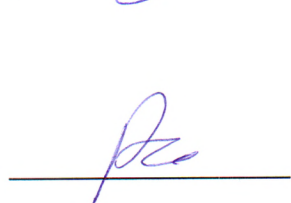
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\_\_\_\_\_ A.U. Vauchok

Curriculum content, composition and the accompanying documents comply with the established requirements.

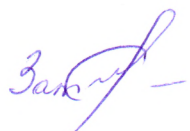
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\_\_\_\_\_ I.L. Kotovich

Methodologist of the Educational and Methodological Department of the Office of Educational Activities of the Educational Institution «Belarusian State Medical University»

24.06.25

  
\_\_\_\_\_ S.V. Zaturanova