

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

Контрольный  
экземпляр

**APPROVED**  
by First Vice-Rector, Professor  
I.N.Moroz  
16.11.2022  
Reg. # UD-16.748/2223/edu.

**PHARMACOLOGY**

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

**1-79 01 07 «Dentistry»**

Curriculum is based on the educational program «Pharmacology», approved 16.11.2022, registration # УД-Л.748/2223/уч.; on the educational plan in the specialty 1-79 01 07 «Dentistry», approved 18.05.2022, registration # L.79-1-7/2223/mf.

**COMPILERS:**

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**RECOMMENDED FOR APPROVAL:**

by the Department of Pharmacology of the educational institution «Belarusian State Medical University»  
(protocol # 16 of 29.09.2022)

by the Scientific and Methodological Council of the educational institution «Belarusian State Medical University»  
(protocol # 9 of 16.11.2022)

## EXPLANATORY NOTE

«Pharmacology» – the academic discipline of the Biomedical Module #2, which contains systematized scientific knowledge about medicines, their properties and application.

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

The objectives of the discipline «Pharmacology» are to form 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, the principles of their combined use;

- the nature and manifestations of the 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 necessary 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 drugs 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 successful mastering of the following academic disciplines: «Internal Diseases», «Pediatrics», modules: «General Clinical Surgical Module», «General Clinical Therapy Module 2», «Therapeutic Dentistry», «Periodontology», «Oral and Maxillofacial Surgery Module», «Pediatric Dentistry».

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

BPC. Use knowledge about the pharmacological properties of medicines, to master the principles of choosing rational pharmacotherapy for dental diseases and for preventive purposes.

**As a result of studying the 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;  
 pharmacological properties and fundamentals of clinical use of drugs;  
 conditions and restrictions on the use of pain medications, methods of combating drug addiction;  
 features of the use of drugs in dentistry;  
 rules for clinical approbation and registration of new medicines;

**be able to:**

choose the method of administration of the medicinal product and its dosing regimen based on the goals of pharmacotherapy, pharmacokinetic data of the medicinal product, and the clinical characteristics of the patient;

work with drug reference guides;

**master:**

principles for calculating an individual dosing regimen of drugs based on pharmacokinetic data and individual characteristics of the patient;

skills of 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 138 academic hours. Classroom hours according to the types of studies: lectures – 20 hours (including 6 hours of supervised student independent work), practical classes – 72 hours, student independent work (self-study) – 46 hours.

Intermediate assessment is carried out according to the syllabus of the specialty in the form of examination (5 semester).

Form of higher education – 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	laboratory studies (practical classes and seminars)		
1-79 01 07 «Dentistry»	4	72	48	12	4	36	24	examination
	5	66	44	8	2	36	22	
<b>Total hours</b>		<b>138</b>	<b>92</b>	<b>20</b>	<b>6</b>	<b>72</b>	<b>44</b>	



## THEMATIC PLAN

Section (topic) name	Number of class hours	
	lectures	practical
<b>1. Subject of pharmacology. Terminology. Sources and stages of creation of drugs. Legislation for drugs</b>	-	<b>1</b>
<b>2. Rules for the prescribing drugs in various dosage forms</b>	-	<b>5</b>
<b>3. Pharmacokinetics of drugs</b>	<b>2</b>	<b>4</b>
<b>4. Pharmacodynamics of drugs</b>	<b>2</b>	<b>2</b>
<b>5. Drugs affecting the peripheral nervous system</b>	<b>4</b>	<b>10</b>
5.1. Cholinergic drugs	2	4
5.2. Adrenergic drugs	2	4
5.3. Drugs affecting on afferent transmission of nerve impulses	-	2
<b>6. Drugs affecting the central nervous system</b>	<b>2</b>	<b>10</b>
6.1. General anesthetics. Ethyl alcohol	-	2
6.2. Analgesics	2	2
6.3. Anticonvulsants and antiparkinson drugs	-	2
6.4. Psychotropic drugs	-	4
<b>7. Drugs affecting on the function of the executive organs</b>	<b>2</b>	<b>14</b>
7.1. Drugs affecting on the function of the respiratory system	-	2
7.2. Drugs affecting on the function of the digestive system and myometrium contractility	-	2
7.3. Drugs affecting the blood system	-	2
7.4. Drugs affecting the cardiovascular system and kidney function	<b>2</b>	<b>8</b>
<b>8. Drugs that regulate tissue metabolism</b>	<b>2</b>	<b>6</b>
8.1. Hormonal and anti-hormonal agents	-	2
8.2. Anti-inflammatory agents		2
8.3. Antiallergic agents and immunomodulators. Vitamins and vitamin-like drugs	2	2
<b>9. Chemotherapeutic agents</b>	<b>4</b>	<b>12</b>
9.1. Chemotherapy infections. Basic concepts. Chemotherapeutic agents	1	6
9.2. Synthetic antimicrobials. Antimycobacterial drugs	1	2
9.3. Antiviral and antimycotic agents	1	2
9.4. Antiseptics and disinfectants. Antiprotozoal and antiparasitic agents. Anticancer drugs	1	2

Section (topic) name	Number of class hours	
	lectures	practical
<b>10. Drugs used in dentistry</b>	<b>2</b>	<b>4</b>
10.1. Means regulating metabolism in solid tissues of the tooth, the formulations of phosphorus, calcium and fluoride. Drugs affecting on the regeneration processes	1	2
10.2. Drugs used for impact to the mucosa of the oral cavity and the dental pulp	1	2
<b>11. Drug-to-drug interactions. Pharmacogenetics</b>	-	<b>2</b>
<b>12. The principles of treatment of acute drug poisoning</b>	-	<b>2</b>
<b>Total hours</b>	<b>20</b>	<b>72</b>

## CONTENT OF THE EDUCATIONAL MATERIAL

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

The concept of pharmacotherapy. The main factors of treatment and therapy methods. Historical stages of development of pharmacology. Formation of pharmacology as a science, the contribution of national scientists in the development of pharmaceuticals.

The essence of pharmacology as a science of managing the vital processes of the organism with chemicals. Basic concepts and terms of pharmacology: pharmacological activity, action and efficiency of chemical substances. Drugs and pharmaceuticals, drug names. Benefits and risks of drug use. Government policies on drugs, state and public control trafficking drugs.

Sections of modern pharmacology: pharmacokinetics and pharmacodynamics, clinical pharmacology, field of pharmacology (neuropharmacology, Immunopharmacology, chronopharmacology etc.). Pharmacy. The chemical nature of drugs. Chemical and physicochemical determinants of the pharmacological activity of drugs. Factors for providing the therapeutic effect of drugs, the placebo effect and pharmacodynamic effects. Sources and stages of drug development.

### 2. Rules for the prescribing drugs in various dosage forms

Concept of medicinal substance, medicinal agent (medicinal drug, drug), medicinal form. Sources of drugs. State Pharmacopoeia, its content and purpose. The International Pharmacopoeia. Drugstore. Storage and dispensing.

Recipe. Its structure. Regulations prescribing. Features of prescribing narcotics, toxic and potent substances.

Rules for writing prescriptions when appointing drugs in various dosage forms.

Solid dosage forms: powders, tablets, dragees, capsules. Their characteristics, advantages and disadvantages. Rules of their prescribing.

Liquid dosage forms. General characteristics and rules of prescribing liquid dosage forms. Dosing. Solutions for external application and oral administration.



Solvents. Official solutions. Suspensions. Liquid dosage forms produced from medicinal plant material. Tinctures, broths, teas, herbal preparations, neogalenic drugs, mucus, emulsions, liniments. Mixtures.

Major groups of drugs intended for injection. General characteristics and requirements for dosage forms for injection. Prescribing rules injectables produced at the factory and in the pharmacy.

Soft medicinal forms. Ointments, pastes. The base for preparation of ointments. Rules of manufacture and prescribing. Dosed soft medicinal forms. Suppositories, rules of prescribing. them.

### **3. Pharmacokinetics of drugs**

#### *Basics of pharmacokinetics*

Transfer of drugs in the body - absorption, distribution, excretion. Movement of drugs through the barriers. Determinants of migration. Water diffusion. Diffusion in lipids: the driving force, conditions and restrictions, the rate of diffusion. Migration of substances through the membrane with a variable ionization. Transfer control. Active transport of substances. The main factors affecting the transport of drugs in the body.

Ways of introducing drugs into the human body, their goals, advantages, disadvantages. Presystemic elimination of drugs. Distribution of medicinal substances in the human body (water spaces and cellular compartments), distribution rate.

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

Drug dosing goals and variables: dose, types of doses, routes and intervals of administration. Introductory (loading, bolus) 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 sense, calculation of maintenance doses to ensure the optimal dosing regimen.

The 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. Steady-state blood drug concentration ( $C_{SS}$ ), time to reach it, calculation and control of  $C_{SS}$ .

Intermittent (discrete) dosing: fluctuations in the concentration of the drug in the blood, therapeutic and toxic concentration ranges. Calculation of the  $C_{SS}$  of the medicinal substance and the limits of its fluctuations (minimum ( $C_{SSmin}$ ) and maximum ( $C_{SSmax}$ )) for discrete dosing of medicinal products, control of the concentration of the medicinal substance. Adequate interval for the introduction of discrete doses.

#### *Biotransformation and excretion of drugs*

Biotransformation of drugs and the need for it, its biological meaning. The main direction, tissue localization. Influence on the activity of biotransformation of drugs. Phase transformations metabolic drugs. The clinical significance of biotransformation of drugs, diseases affecting the biotransformation of drugs.

Clearance - the main determinant of pharmacokinetics. Renal clearance of drugs



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

#### **4. Pharmacodynamics of drugs**

Nature of the biological action of chemicals. The concept of receptors in pharmacology. Chemical and physico-chemical determinants of the pharmacological activity of drugs, affinity and intrinsic activity of drugs. Interaction 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, efficiency, activity. Quantitative laws of drug action. The law of decreasing the 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 evaluating the effect of drugs (gradual, quantum), their essence and clinical applications. Variability and changeability of drug action. Hyporeactivity, hyperreactivity, hypersensitivity, idiosyncrasy. Tolerance and its particular cases (tachyphylaxis, mithridatism). Cumulation. Causes and consequences of the variability of the action of drugs. Drug addiction.

Types of doses: minimal, average and highest therapeutic doses, single, daily and course doses, introductory and maintenance doses, toxic doses. Assessment of drug safety. Therapeutic index and standard safety margins.

Factors that provide therapeutic, side and toxic effects of drugs. Polytropism and pleiotropy of drugs, clinical significance. The effect 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.

Interaction of drugs, its types. Drug synergism, addiction and potentiation of effects. Synergistic drug combinations as the basis of modern pharmacotherapy. Antagonism of drugs, its types and clinical significance.

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

#### **5.1. Cholinergic drugs**

The general scheme of the structure, neurotransmitters and receptors in the peripheral (somatic and autonomic) nervous system. Cholinergic transmission signals. Structure and mechanism of cholinergic synapses of nerve impulse transmission. The mechanism of acetylcholine release and its regulation. Molecular structure and heterogeneity of cholinergic receptors: muscarinic ( $M_1$ ,  $M_2$ ,  $M_3$ ) and nicotinic ( $N_m$ ,  $N_n$ ) cholinergic receptors. Localization and effects of physiological and pharmacological stimulation. Extrasynaptic cholinergic receptors.

Cholinergic agonists. M-cholinomimetics (*pilocarpine*, *cevimeline*): effects on the eye (the width of the pupil, intraocular pressure, accommodation), the smooth muscles of internal organs, secretion of glands, heart and vessels; indications for use. M, N-cholinomimetics (*acetylcholine chloride*, *carbachol*). Pharmacological effects. N-cholinomimetics: (*nicotine*, *lobeline*, *cytisine*). Nicotine pharmacology and toxicology; nicotineism. Nicotinomimetics use in smoking control.

Anticholinesterase drugs: a) reversible cholinesterase inhibitors (*neostigmine*, *physostigmine*); b) irreversible cholinesterase inhibitors (organophosphorous

compounds). The main pharmacological effects. Adverse and toxic effects of anticholinesterases. Treatment of poisoning. Application of cholinesterase reactivators (*pralidoxime mesylate*) and anticholinergic (*atropine*) for treatment of poisoning. Stimulants of endogenous acetylcholine release: *itopride*.

Anticholinergic agents. Agents that inhibit the release of acetylcholine (botulinum toxin A); application, side effects. M-anticholinergics (M-cholinolytics): *atropine, dicycloverine, scopolamine, ipratropium bromide, pirenzepine, oxybutinine, tolterodine, darifenacine*. Comparative characteristics of M-cholinergic antagonists. Application in medicine. Poisoning with M-cholinergic antagonists and medical aid. Ganglioplegic (Nn-anticholinergics): *trimetaphan, hexamethonium benzosulphonate*. The main effects. Indications for application. Side effects. Curariform agents (muscle relaxants, anticholinergics-Nm): *pipekuronium bromide, atracurium, suxamethonium chloride*. Classification. Mechanisms of action of anti-depolarizing and depolarizing curariform drugs. Application. Possible complications. Antagonists of curariform drugs. Central cholinolytics: *trihexyphenidyl, biperiden*. Pharmacological effects. Their use.

## 5.2. Adrenergic drugs

Adrenergic signaling. Structure of adrenergic synapses and mechanism of nerve impulse transmission. Regulation of the release of mediators and their metabolism. Heterogeneity of adrenoceptors:  $\alpha$  and  $\beta$ -adrenoceptors: localization and effects of pharmacological and physiological stimulation.

Adrenergic agonists (adrenomimetics).

$\alpha$ - adrenomimetics [ $\alpha_1$ -adrenomimetics (*phenylephrine*);  $\alpha_2$ -adrenomimetics (*clonidine*);  $\alpha_1$ - &  $\alpha_2$ -adrenomimetics (*naphazoline, xylomethazoline*)];

$\beta$ -adrenomimetics [ $\beta_1$ -adrenomimetics (*dobutamine*);  $\beta_2$ - adrenomimetics (*salbutamol, salmeterol, terbutaline*);  $\beta_1$ -,  $\beta_2$  &  $\beta_3$ -adrenomimetics (*isoprenaline*)];

mixed ( $\alpha$  &  $\beta$ )- adrenomimetics (*epinephrine* –  $\beta_1$ ,  $\beta_2$ ,  $\beta_3$ ,  $\alpha_1$ ,  $\alpha_2$ -agonist, *norepinephrine* –  $\alpha_1$ ,  $\alpha_2$ ,  $\beta_1$ ,  $\beta_3$ -agonist, *dopamine* – D,  $\alpha_1$ ,  $\alpha_2$ ,  $\beta_1$ -agonist).

Adrenoceptor blocking agent (adrenolytics).

$\alpha$ -adrenoblockers [ $\alpha_1$ -adrenoblockers (*doxazosin, prazosin, tamsulosin*);  $\alpha_2$ -adrenoblockers (*yohimbine*);  $\alpha_1$ - &  $\alpha_2$ -adrenoblockers nonselective (*phentolamine, dihydroergotamine*)];

$\beta$ -adrenoblockers [ $\beta_1$  - &  $\beta_2$ -adrenoblockers nonselective (*propranolol, nadolol, sotalol*);  $\beta_1$ -adrenoblockers (cardioselective) (*metoprolol, atenolol*);

mixed ( $\alpha$  &  $\beta$ )- adrenoblockers (*carvedilol, labetalol*).

Pharmacological effects of adrenergic antagonists of various groups. Application in medicine, adverse and toxic effects.

Means of presynaptic action. Local anesthetics: *procaine, lidocaine, bupivacaine, articaine, tetracaine, bupivacaine, ropivacaine, benzocaine*. Classification, mechanism of action. Comparative characteristics of drugs in terms of strength and duration of action. Application for different types of anesthesia (infiltration, conduction, superficial); selection of medicines for intraligamentary and intrapulpal anesthesia, medicines for anesthesia of hard tissues of the tooth. The use of adrenomimetics (epinephrine) for the prolongation of anesthesia. Change in the



activity of anesthetics when injected into inflamed tissue. Toxic effect of local anesthetics, measures to prevent it.

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

### 5.3. Drugs affecting on afferent transmission of nerve impulses

Local anesthetics. *Procaine, tetracaine, benzocaine, lidocaine, bupivacaine, articaine, pyromecaine, bumecaine, ropivacaine, mepivacaine*. Classification, mechanism of action. Influence of pH on the intensity of anesthetic effect. Comparative characteristics of drugs and their use for different types of anesthesia. Choice of drugs for intraligamentary and intrapulpar anesthesia. Drugs for analgesia dental hard tissues. Toxic effect of local anesthetics and measures to prevent it. Astringents – *tannin, zinc oxide, bismuth subnitrate, decoction of oak bark, an infusion of sage leaves, of chamomile flowers, herbae hyperici*. Enveloping: *mucus from starch and flax seed, egg white (albumine) solution, etc*. Absorbent: *activated charcoal, white clay, talc, zinc oxide*. Irritants: *mustard, essential oils, turpentine oil purified, menthol, validol, ammonia, clove oil, eugenol*. The mechanism of action. Use in dentistry.

## 6. Drugs affecting the central nervous system

### 6.1. General anesthetics. Ethyl alcohol

The definition of general anesthesia (narcosis). Inhaled and non-inhaled anesthesia. Stage of narcosis. Requirements for an ideal drugs. The notion of activity inhaled anesthetics (minimum alveolar concentration (MAC)). Molecular and neurophysiological mechanisms of action of anesthetics: non-specific effects on neuronal membranes; effect on the function of sodium channels.

Remedies for inhalation anesthesia: *halothane, isoflurane, sevoflurane, dinitrogen oxide (nitrous oxide)*.

Remedies for not inhaled (intravenous) anesthesia: *sodium thiopental, ketamine, propofol*.

Clinical use of general anesthetics, types of narcosis, the width of therapeutic action. Side effects of drugs for anesthesia.

Ethyl alcohol. Local and resorptive effect of ethyl alcohol; use in medical practice. Acute poisoning with ethyl alcohol. Assistance measures. Chronic poisoning with ethyl alcohol (alcoholism). Principles and treatment for alcoholism (*disulfiram, apomorphine*).

### 6.2. Analgesics

Conception of the systems of perception and regulation of pain in the human body. Nociceptive system, specific and non-specific way of pain sensation; pain mediators. Antinociceptive system mediators their predecessors. Opiate receptors – localization, heterogeneity ( $\mu$ -,  $\kappa$ -,  $\delta$ -), the effects of their activation.

*Narcotic analgesics (opiates) and their antagonists*. Opioid receptor agonists: *morphine, codeine, dihydrocodeine; methadone; trimeperidin, fentanyl*. Agonist-antagonists (*pentazocine*), and partial opioid receptor agonists (*buprenorphine*). Opioid antagonists (*naloxone, naltrexone*).



The main pharmacological effects of opioids, the molecular and cellular mechanisms of action. Pharmacokinetics of opioids. The main groups of opioids and their characteristics. Medical use of narcotic analgesics. Adverse and toxic effects. Acute poisoning by opioids and assistance measures. Chronic toxicity and drug dependence. Treatment of addiction and withdrawal syndrome. Drug interaction of opioids with sedative-hypnotic, antipsychotic, anxiolytic and anticholinergic agents.

*Non-narcotic analgesics.* Analgesics of central action – nefopam, paracetamol; inhibitors of cyclooxygenase in peripheral tissues and the central nervous system – ibuprofen, ketorolac, acetylsalicylic acid, combined agents.

*Mixed-action analgesics* (tramadol).

Mechanisms of analgesic and antipyretic action. Application, side effects, contraindications. Comparative characteristics of non-narcotic and narcotic analgesics. The concept of neuroleptanalgesia.

*Drugs used for neuropathic pain syndromes.* Migraine. Medications for the relief acute attacks of migraine: *acetylsalicylic acid, paracetamol*, agonists of serotonin 5HT<sub>1</sub> receptors (*sumatriptan*), ergot alkaloids (*ergotamine*), antiemetics (*metoclopramide*). Prophylaxis of migraine: *pizotifen, erenumab, β-blockers, tricyclic antidepressants, Ca<sup>2+</sup> channel blockers, cyproheptadine*.

Acute and chronic pain syndromes (supportive means): *clonidine, amitriptyline, carbamazepine, gabapentin, corticosteroids, baclofen, diphenhydramine*. Mechanisms of analgesic action, their application.

### 6.3. Anticonvulsants and antiparkinson drugs

*Anticonvulsants: sodium valproate, carbamazepine, phenytoin, gabapentin, ethosuximide, phenobarbital.* Mechanism of anticonvulsant action, use and side effects.

Means to reduce spasticity – *tizanidine, baclofen*.

*Agent for the treatment of Parkinson's disease: levodopa, selegiline, bromocriptine, pramipexol, trihexyphenidyl.* 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.

### 6.4. Psychotropic drugs

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

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

Anxiolytics: *alprazolam, diazepam, oxazepam, chlordiazepoxide, buspirone hydrochloride*.

Sedative means: herbal remedies (*valerian, motherwort*); bromides (*sodium bromide*); combined drugs (*corvalol*).

Hypnogenic agents: *triazolam, nitrazepam, zaleplon, zopiclone, zolpidem, chloral hydrate*.

Means for correcting circadian rhythm disorders (*melatonin*).

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 agents, limitations of their use. Acute poisoning with benzodiazepines, benzodiazepine antagonist (*flumazenil*).

*Antipsychotics (neuroleptics).*

Antipsychotics as a special class of psychopharmacological agents. The concept of neuroleptia. Antipsychotics:

of first generation: *chlorpromazine, flupentixol, haloperidol, droperidol*;

of second generation (atypical antipsychotics): *clozapine, risperidone, aripiprazole*.

Neurophysiological effects and mechanisms of antipsychotic action. Application principles. Side and toxic effects (effect on the central nervous system, autonomic functions, endocrine system).

*Antidepressants (thymoanaleptics).*

Tricyclic antidepressants: *imipramine, amitriptyline, venlafaxine*.

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

Atypical antidepressants: *mianserin, tianeptine, trazadone*.

Monoamine oxidase inhibitors (*moclobemide*).

Use in medicine, side effects.

*Normothymic (antimanic) means.*

Lithium salts – *lithium carbonate*, etc. Mechanism of action, application, side effects.

*Nootropic, psychostimulant, analeptics.*

Nootropics: *piracetam, vinpocetine, nimodipine, donepezil hydrochloride, memantine*.

Psychostimulants: *caffeine, mesocarb*.

Analeptics: *nikethamide, doxapram hydrochloride, caffeine sodium benzoate*.

Pharmacological effects, application, side effects.

## **7. Drugs affecting on the function of the executive organs**

### **7.1. Drugs affecting on the function of the respiratory system**

*Drugs used for the treatment of bronchial asthma and for relief of bronchial spasm:*  $\beta$ -agonists (*salbutamol, terbutaline, salmeterol*), glucocorticosteroids (*beclomethasone, budesonide*), inhibitors of the release of allergy mediators (*cromoglycic acid, ketotifen*), M-cholinergic blockers (*ipratropium bromide*), leukotriene receptor antagonists (*montelukast*), phosphodiesterase inhibitors (*aminophylline*). The choice of drug for the relief of asthmatic attacks or their prevention.

*Respiratory stimulants:* *almytrine, doxapram, nicketamide, etimizol, bemegrade* (stimulants of the respiratory center);

*Surfactants:* *kolfostseril palmitate* and their synthetic stimulants (*ambroxol*). Methods of their use.

*Expectorants and mucolytics:* *termopsis drugs, potassium iodide, ambroxol, acetylcysteine, dornase alpha*.

Antitussives: *codeine, dextromethorphan, prenoxdiazine*.

Principles of action of drugs of various groups, use, side effects.

Means used in the treatment of pulmonary edema: *morphine, furosemide, mannitol, sodium nitroprusside, azamethonium, aminophylline, ethyl alcohol*.



Principles of pharmacotherapy of pulmonary edema. The effect of ethyl alcohol, oxygen therapy.

## **7.2. Drugs affecting on the function of the digestive system and myometrium contractility**

*Medications used to treat 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. Vonoprazan.

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

Selective M<sub>1</sub> anticholinergics (pirenzepine).

Blockers of gastrin receptors (proglumide).

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

Helicobacter pylori eradication agents: proton pump blockers, clarithromycin, amoxicillin, bismuth preparations, metronidazole, levofloxacin.

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

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

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

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

Laxatives: senna preparations, bisacodyl, magnesium sulfate, lactulose, methylcellulose, vaseline oil. Localization of action and the rate 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 drug depending on the cause and mechanism of vomiting.

*Hepatotropic agents.*

Choleretic agents: dehydrocholic acid, osalmid, magnesium sulfate, drotaverine, M-anticholinergics, phytopreparations.

Cholelitholytics (ursodeoxycholic acid).

Hepatoprotectors: betaine, ademethionine, silibinin, ursodeoxycholic acid, essential phospholipids.

*Means that affect the function of the pancreas:* dilute hydrochloric acid, pancreatin, cholecystokinin, M-anticholinergics, proteinase inhibitors (aprotinin). Principles of pharmacotherapy of acute and chronic pancreatitis.

*Drugs that affect appetite and digestion.*

Antianorexigenic agents (increasing appetite): wormwood tincture, cyproheptadine.

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



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

Means for the treatment of obesity: anorexigenic agents, intestinal lipase inhibitors (orlistat), agents that create a satiety effect (methylcellulose), hypoglycemic agents (metformin, acarbose).

*Drugs affecting the tone and contractile activity of the myometrium.*

Means to enhance labor activity (oxytocin, prostaglandins – dinoprost, dinoprostone); agents for stopping uterine bleeding (ergot preparations, oxytocin), agents that reduce myometrium tone (hexoprenaline). Principles of action, application.

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

*Means affecting hematopoiesis.*

Means used for anemia: drugs containing iron, cyanocobalamin, folic acid, epoetin alfa.

Causes of anemia, principles of pharmacotherapy of anemia. Poisoning with drugs containing iron, antidotes (deferoxamine).

Means that stimulate leukopoiesis (molgramostim, filgrastim).

Drugs that inhibit hematopoiesis (antiblastoma drugs).

*Agents affecting hemostasis.* Classification of drugs that regulate 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, clopidogrel, dazoxybenz, prazugrel, pentoxifylline, abciximab.

Anticoagulants: sodium heparin, calcium nadroparin, antithrombin III, danaparoid sodium, dabigatran etexilate, fondaparinux, rivaroxaban, warfarin.

Thrombolytic agents: fibrinolytin, streptokinase, alteplase.

Hemostatic agents: preparations of blood coagulation factors, eltrombopag, phytonadione, calcium salts, tranexamic acid, thrombin.

### **7.4. Drugs affecting the cardiovascular system and kidney function**

*Diuretics:* hydrochlorothiazide, indapamide, furosemide, spironolactone, eplerenone, triamterene, mannitol, acetazolamide. Classification. Mechanisms of diuretic action, speed of onset and duration of effect. Effect of diuretics on ionic balance. Application, side effects.

*Antihypertensive agents.*

The main groups of antihypertensive drugs:

diuretics: hydrochlorothiazide, indapamide, furosemide, spironolactone, eplerenone, triamterene;

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

sympathoplegic agents of central action (clonidine, methyl dopa, moxonidine);

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

$\alpha_1$ -blockers (doxazosin);

calcium channel blockers: nifedipine and its retard forms, amlodipine;

vasodilators (diazoxide, sodium nitroprusside);

sympatholytics (guanethidine).

Principles of pharmacotherapy of arterial hypertension. Differences in pharmacotherapeutic approaches to the treatment of arterial hypertension and relief of hypertensive crises.

*Antianginal agents.*

The main groups of antianginal drugs:

β-blockers: propranolol, atenolol, metoprolol;

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

organic nitrates and nitrate-like agents: nitroglycerin, isosorbide dinitrate, molsidomine. Tolerance to nitrates.

Principles of action of antianginal drugs. The choice of drugs for the relief and prevention of an attack of angina pectoris.

*Lipid-lowering drugs:* statins (atorvastatin), ezetimibe, nicotinic acid, fibrates (gemfibrozil), bile acid sequestrants (colestyramine). Principles of action, clinical application.

*Medicines for the treatment of heart failure (HF).*

Essential medicines for the treatment of HF:

RAAS inhibitors: captopril, enalapril, losartan, sacubitril/valsartan;

β-blockers: metoprolol, bisoprolol, carvedilol;

diuretics: hydrochlorothiazide, indapamide, furosemide;

aldosterone antagonists: spironolactone, eplerenone, finerenone;

inotropic agents:

cardiac glycosides – digoxin. Action on the contractile and bioelectrical functions of the heart. Essence of therapeutic action in cardiac decompensation. Side and toxic effects of cardiac glycosides: arrhythmogenic, effects on the gastrointestinal tract, neurotoxic effects. Application. Possible causes of digitalis intoxications, principles of therapy;

other inotropic agents (non-glycoside): dopamine, dobutamine, milrinone, levosimendan. Mechanisms of inotropic action, areas of application.

Supportive means: peripheral vasodilators, antihypoxants.

*Antiarrhythmic drugs.*

Classification of antiarrhythmic drugs (AAD) by electrophysiological and pharmacological action on the myocardium.

AAD used in tachyarrhythmias: membrane-stabilizing Na<sup>+</sup>-channel blockers (procainamide, lidocaine, propafenone), β-blockers (propranolol, metoprolol), K<sup>+</sup>-channel blockers (amiodarone, sotalol), Ca<sup>2+</sup>-channel blockers (verapamil), purinergic receptor agonists (adenosine).

AAD used in bradyarrhythmias: M-cholinergic blockers, β-agonists.

The main mechanisms of antiarrhythmic action. Areas of application of AAD, side effects.

## **8. Drugs that regulate tissue metabolism**

### **8.1. Hormonal and anti-hormonal agents**

*Preparations of hormones of the hypothalamus and pituitary gland.*

Preparations of hormones of the hypothalamus: octreotide, gonadorelin, goserelin, protirelin.



Anterior pituitary hormone preparations: somatropin, gonadotropins (urofollitropin, chorionic gonadotropin, lutropin alfa, menotropins), thyrotropin.

Posterior pituitary hormone preparations: oxytocin, desmopressin, terlipressin.

Influence of hypothalamic and pituitary preparations on hormonal status, pharmacological effects, application.

*Thyroid and antithyroid drugs.*

Thyroid hormone preparations: levothyroxine sodium (T<sub>4</sub>), liothyronine (T<sub>3</sub>). Therapeutic application.

Antithyroid drugs: thiamazole, propylthiouracil, iodides, radioactive iodine;  $\beta$ -blockers (propranolol). Mechanisms of action, uses, side effects and complications.

*Hormonal regulators of mineral homeostasis and other drugs that affect bone metabolism.*

Parathyroid hormone preparations (teriparatide). Influence on the exchange of phosphorus and calcium. Application.

Antiparathyroid drugs (caltitonin, paricalcitol). Bisphosphonates (sodium alendronate, zoledronic acid). Vitamin D and analogues (alfacalcidol, paricalcitol). Mechanism of action. Application in medical practice.

*Pancreatic hormone preparations and synthetic antidiabetic agents.*

Short-acting and long-acting insulin preparations. Effect of insulin on metabolism. Routes of insulin administration, complications of insulin therapy.

Oral hypoglycemic agents: glibenclamide, metformin. Mechanism of action, indications for use, side effects. Other antidiabetic agents: increasing tissue sensitivity to insulin (pioglitazone), stimulating the release of insulin (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 hydrochloride, glucocorticosteroids. Mechanisms of action, application.

*Preparations of hormones of the adrenal cortex.*

Glucocorticosteroids (GCS): hydrocortisone, methylprednisolone, prednisolone, triamcinolone, dexamethasone, betamethasone, fluocinolone acetonide.

The effect of GCS on metabolism in the human body. Anti-inflammatory and anti-allergic properties of GCS. Therapeutic use, side effects. Synthetic corticosteroids for local use.

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

Corticosteroid synthesis inhibitors (aminoglutethimide).

*Preparations of female sex hormones.*

Estrogen drugs: estradiol, ethinylestradiol, hexestrol.

Progestin preparations: progesterone, dydrogesterone.

Chemical structure and physiological significance of estrogens and gestagens, therapeutic use.

Estrogen and progestin antagonists: tamoxifen, mifepristone. Application in medicine.



Contraceptives (contraceptives): combined oral contraceptives (marvelon, anteovin, triregol), norethisterone, levonorgestrel. Principles of action, side effects.

*Preparations of male sex hormones, anabolic steroids.*

Androgenic drugs (testosterone and its esters). pharmacological activity. Indications for use, side effects.

Antiandrogenic drugs (finasteride, flutamide). Application in medicine.

Anabolic steroids (nandrolone). The influence of anabolic steroids on metabolic processes. Application, side effects.

### **8.2. Anti-inflammatory agents**

Glucocorticosteroids (GCS), *prednisolone, methylprednisolone, triamcinolone, dexamethasone, betamethasone.*

Nonsteroidal antiinflammatory drugs (NSAIDs), *acetylsalicylic acid, indomethacin, ibuprofen, ketoprofen, ketorolac, diclofenac, meloxicam, nimesulide, celecoxib, etoricoxib.*

Mechanisms of anti-inflammatory action. Indications and contraindications for use. Side effects, their prevention.

*Anti-gout agents.*

Uric acid synthesis inhibitors (*allopurinol, febuxostat*), uricosuric agents (*sulfinpyrazone, probenecid*), *pegloticase*; drugs used in acute attacks of gout: NSAIDs, corticosteroids, *colchicine*. Mechanisms of action, uses, side effects.

### **8.3. Antiallergic agents and immunomodulators. Vitamins and vitamin-like drugs**

*Agents used for immediate allergic reactions.*

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

Mast cell membrane stabilizers (cromoglycic acid).

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

Leukotriene receptor antagonists (zafirlukast).

Mechanisms of action of antiallergic drugs, comparative characteristics, side effects, application.

*Means used in anaphylactic shock:* epinephrine, corticosteroids, dopamine, salbutamol, antihistamines. Principles of action.

*Drugs used in delayed-type allergic reactions.*

Basic antirheumatic drugs: auranofin, penicillamine, chloroquine, sulfasalazine; immunosuppressants: cyclosporine, tacrolimus, antilymphocyte immunoglobulins, monoclonal antibody preparations – infliximab, basiliximab; cytotoxic agents – methotrexate.

*Immunomodulators.*

Immunoregulatory peptides – interferon gamma-1b and other interferons; interferonogens - tilorone, arbidol; thymus preparations – thymogen. Mechanisms of action. Application in medical practice. Immunosuppressive properties of cytostatic agents (antiblastoma agents).

*Vitamins and vitamin-like products.*

Classification, sources of obtaining, pharmacodynamics of vitamin preparations, indications for use and side effects, features of action and comparative characteristics. Causes of hypovitaminosis.

Preparations of water-soluble vitamins: thiamine, riboflavin, calcium pantothenate, folic acid, nicotinic acid, pyridoxine, cyanocobalamin, ascorbic acid, rutin, quercetin.

Preparations of fat-soluble vitamins: retinol, ergocalciferol, alfacalcidol, calcitriol, paricalcitol, phytomenadione, tocopherol. Hypervitaminosis in the treatment of retinol and ergocalciferol.

Preparations of vitamin-like compounds: choline chloride, calcium pangamat, inosine. Multivitamin and combined preparations with minerals. The concept of antivitamin.

*Salts of alkali and alkaline earth metals:* sodium chloride, potassium chloride, calcium chloride, magnesium sulfate.

Isotonic, hypertonic and hypotonic solutions of sodium chloride. Application. The value of potassium ions for the function of the nervous and muscular systems. Participation of sodium and potassium ions in the transmission of nervous excitation. regulation of potassium metabolism. The use of potassium preparations. Influence of calcium ions on the central nervous system, cardiovascular system, cell permeability. regulation of calcium metabolism. The use of calcium preparations. Therapeutic use of magnesium preparations. Antagonism between calcium and magnesium ions.

**9. Chemotherapeutic agents****9.1. Chemotherapy infections. Basic concepts. Chemotherapeutic agents**

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

*Antibiotics*

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

Penicillins: benzylpenicillin (Na and K salts), benzathine benzylpenicillin (bicillin-1); phenoxymethylpenicillin, oxacillin, amoxicillin, carbenicillin, piperacillin, pivmecillinam; combined drugs based on penicillins with  $\beta$ -lactamase inhibitors - clavulanic acid, sulbactam, tazozime.

Cephalosporins and cefamycins: cefazolin, cephalexin, cephadrine, cefuroxime, cefoxitin, cefotaxime, ceftazidime, ceftriaxone, cefepime. Classification of cephalosporins according to the spectrum of antimicrobial activity (generations I-IV), resistance to  $\beta$ -lactamase, route of administration.

Carbapenems: imipenem, meropenem, ertapenem.

Monobactams (aztreonam).

Glycopeptides: vancomycin, teicoplanin.

Antibiotics that disrupt the permeability of the cytoplasmic membrane.

Polypeptides: polymyxins B, M.



Polyenes: nystatin, amphotericin B.

Antibiotics that inhibit the synthesis of nucleic acids are ansamycins (rifampicin).

Antibiotics that inhibit protein synthesis:

aminoglycosides (aminocyclitols): streptomycin, gentamicin, amikacin, spectinomycin;

tetracyclines: tetracycline, oxytetracycline, doxycycline;

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, indications for use, routes of administration, dosing principles, side and toxic effects.

### **9.2. Synthetic antimicrobials. Antimycobacterial drugs**

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

Oxyquinolines (nitroxoline).

Nitrofurans: nitrofurantoin, furazolidone.

Quinolones and fluoroquinolones: nalidixic acid, ciprofloxacin, levofloxacin.

Nitroimidazoles (metronidazole, tinidazole).

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

#### *Antimycobacterial agents*

Basic (isoniazid, rifampicin, pyrazinamide, ethambutol, streptomycin) and reserve (cycloserine, kanamycin, clofazimine, bedaquiline, delamanid, fluoroquinolones) drugs for the treatment of tuberculosis. Principles of pharmacotherapy of tuberculosis, the concept of chemoprophylaxis. Antileprosy agents.

### **9.3. Antiviral and antimycotic agents**

Anti-influenza drugs: rimantadine / rimantadine, oseltamivir.

Antiherpetic drugs: acyclovir, valaciclovir, idoxuridine, foscarnet.

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

Anticytomegalovirus drugs (ganciclovir).

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

Medicines for the treatment of hepatitis C: daclatasvir, dasabuvir, sofosbuvir.

Means for the treatment of coronavirus infection: remdesivir.

Interferons and interferonogens.

Mechanisms of antiviral action, principles of application, side and toxic effects.

*Antimycotic agents*

Amphotericin B, nystatin; griseofulvin, ketoconazole, clotrimazole, fluconazole, itraconazole, terbinafine. Pharmacodynamics, spectrum of antifungal action of antimycotic agents, indications, side and toxic effects.

**9.4. Antiseptics and disinfectants. Antiprotozoal and antiparasitic agents. Anticancer drugs**

The concept of antiseptic and disinfection. The difference between antiseptic and chemotherapeutic agents. Requirements for antiseptics. Conditions that determine the antimicrobial activity of antiseptics, mechanisms of action. The main groups of antiseptics:

- detergents: N – cetylpyridinium chloride, cerigel;
- metal compounds: zinc sulfate, copper sulfate;
- halogen-containing compounds: chloramine B, alcohol iodine solution;
- acids and alkalis: boric acid, aqueous ammonia solution;
- aromatic antiseptics: pure phenol, resorcinol, polycresulene, triclosan, ambazone, biclotymol, hexetidine;
- aliphatic antiseptics: ethyl alcohol, formaldehyde solution;
- oxidizing agents: potassium permanganate, hydrogen peroxide;
- nitrofuran derivatives (furatsilin);
- dyes: methylene blue, brilliant green;
- biguanides (chlorhexidine);
- imidazole antiseptics (metronidazole);
- quaternary ammonium compounds: benzalkonium chloride, miramistin.

Features of the use of individual antiseptics. Principles of treatment of acute poisoning with antiseptics.

*Antiprotozoal agents*

Antimalarials: artemether, chloroquine, mefloquine, quinine, pyrimethamine, primaquine.

Antiamebic drugs: metronidazole, tinidazole.

Means used for trichomoniasis: metronidazole, tinidazole.

Means used for giardiasis (giardiasis): metronidazole, tinidazole, mepacrine.

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

Medications used in leishmaniasis: sodium stibogluconate, pentamidine isethionate, mepacrine.

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

Antiparasitic (anthelmintic) drugs (mebendazole, pyrantel, albendazole, levamisole, praziquantel, niclosamide): mechanisms of action, principles of application, side effects. Means used for intestinal nematodes, cestodosis and trematodosis: properties, application features, side effects. General characteristics of the means used for extraintestinal helminthiasis.



*Anti-cancer drugs*

Principles of chemotherapy of malignant neoplasms, mechanisms of action of antitumor drugs. Features of the antitumor activity of alkylating agents, antimetabolites, platinum preparations, antibiotics, hormonal preparations and hormone antagonists, enzymes. Complications of tumor chemotherapy, their prevention.

**10. Drugs used in dentistry**

**10.1. Means regulating metabolism in solid tissues of the tooth, the formulations of phosphorus, calcium and fluoride. Drugs affecting on the regeneration processes**

*Preparations of calcium, phosphorus, fluorine:*

calcium preparations: calcium chloride, calcium gluconate, calcium lactate, calcium hydroxide;

phosphorus preparations: calcium glycerophosphate, phytin;

fluorine preparations: sodium fluoride, sodium monofluorophosphate, tin fluoride, olaflur, dektaflur, fluoride varnish; ways to designate the concentration of fluorine in medical products;

combined preparations of calcium and phosphorus – osteogenon.

*Hormonal agents.* Preparations of thyroid and parathyroid glands: teriparatide; glucocorticosteroids; vitamin D preparations (ergocalciferol, alfacalcidol, calcitriol, paricalcitol); preparations of sex hormones – estrogens, androgens; anabolic steroid.

Indications, side effects, contraindications for the use of drugs that regulate the exchange in the hard tissues of the tooth.

**10.2. Drugs used for impact to the mucosa of the oral cavity and the dental pulp**

Anti-inflammatory drugs:

Astringents: tannin, sage leaf, chamomile flowers, romazulan, oak bark;

Enzyme preparations: trypsin, chymotrypsin, ribonuclease, deoxyribonuclease, lidase;

GCS: hydrocortisone (mucoadhesive buccal tablets), beclomethasone (spray), betamethasone (soluble tablets), systemic GCS; ointments hydrocortisone, prednisolone, flumethasone pivalate (locacorten), fluocinolone acetonide (sinaflan);

NSAIDs: flurbiprofen (lozenges), choline salicylate + cetalkonium chloride (gel), diclofenac (mouthwash solution); ointment phenylbutazone (butadione), indomethacin, mefenamin sodium salt;

Other anti-inflammatory agents: benzydamine (spray, mouthwash solution), dimethyl sulfoxide, heparin ointment.

*Antibacterial drugs and antiseptics:* doxycycline (soluble tablets), biclotymol, cetylpyridinium chloride; chlorhexidine, chlorhexidine + ascorbic acid, chlorhexidine + metronidazole; povidone-iodine + allantoin, hexetidine, doritricin, grammidin, ingalipit;

*Antiviral agents:* oxolin, bonafton, tebprofen, acyclovir, valaciclovir, famciclovir, butaminophen.

*Antifungals:* nystatin, miconazole, fluconazole;

*Means that stimulate tissue regeneration:* vitamins A, E; sea buckthorn and rosehip oil, carotelin, Shostakovsky's balm, methylthiouracil ointment, propolis, actovegin, solcoseryl.

*Pain suppressants:* local action: local anesthetics, astringents, enveloping agents; resorptive action: non-narcotic analgesics (paracetamol, ibuprofen, metamizole).

Means used to eliminate unpleasant odor from the oral cavity (deodorants): mint oil, menthol, metronidazole (gargles).

*Means for the treatment of xerostomia:* saliva secretion stimulants: reflex action – ascorbic acid, nicotinic acid, citric acid, malic acid; cholinomimetics and anticholinesterase means – pilocarpine, cevimeline, bethanechol, neostigmine, pyridostigmine, physostigmine; yohimbine (antagonist of presynaptic  $\alpha_2$  receptors of parasympathetic branches of cranial nerves); saliva substitutes and lubricants: isotonic sodium chloride solution; calcium phosphate; mucin-based products; products based on xylitol or carboxymethylcellulose; lubricants based on Oxidized Glycerol Triesters (OGT, oxygenated triacylglycerols); products containing saliva enzymes (lactoperoxidase, lactoferrin, lysozyme, glucose oxidase).

Means that reduce the secretion of saliva: anticholinergics – atropine; tricyclic antidepressants; neuroleptics of the phenothiazine series; antihistamines of the 1st generation – diphenhydramine; adrenomimetics and sympathomimetics.

### **11. Drug-to-drug interactions. Pharmacogenetics**

Co-administration of drugs. The use of combined drugs in modern pharmacotherapy. Indications for combination therapy. Types and mechanisms of drug interactions. Possible outcomes of drug interactions. Pharmaceutical and pharmacological incompatibility. Polypharmacy. The concept of pharmacogenetics, the effect of gene polymorphism on the pharmacokinetics and pharmacodynamics of drugs.

### **12. The principles of treatment of acute drug poisoning**

Classification of pharmacological substances according to the degree of toxicity and danger (list A). Principles of treatment of poisoning with pharmacological substances. First emergency aid. Measures of assistance depending on the route of entry of substances into the human body. The main groups of antidotes are: toxicotropic antidotes, toxic-kinetic antidotes, pharmacological antagonists, immunological antidotes. The mechanism of action of antidotes. Conditions and restrictions for their use. Prevention of acute drug poisoning.



## ACADEMIC DISCIPLINE CURRICULAR CHART

Section, topic #	Section (topic) name	number of hours			Self-studies	Form of control
		lectures	supervised student work	practical		
	<b>4 semester</b>					
1.	<b>Subject of pharmacology. Terminology. Sources and stages of creation of drugs. Legislation for drugs</b>	-	-	1	2	
2.	<b>Rules for the prescribing drugs in various dosage forms</b>	-	-	5	2	
	Subject of pharmacology. Rules for the prescribing drugs in various dosage forms. Solid drug forms	-	-	2		written classroom practical exercises, accounts of classroom practical exercises with oral defense
	Liquid drug forms					written classroom practical exercises, accounts of classroom practical exercises with oral defense
		-	-	2	1	
	Semi-solid (soft) drug forms. Injectable drug forms					written classroom practical exercises, accounts of classroom practical exercises with oral defense, accounts of home practical exercises with oral defense
		-	-	2	1	
3.	<b>Pharmacokinetics of drugs</b>	2	1	2	2	interviews, control questioning, written classroom practical exercises

4.	<b>Pharmacodynamics of drugs</b>	2	1	2	2	2	interviews, control questioning, written classroom practical exercises
	<b>Final lesson on «Rules for the prescribing drugs in various dosage forms», «Pharmacokinetics of drugs», «Pharmacodynamics of drugs»</b>	-	-	2	2	2	colloquium, control questioning, electronic tests
5.	<b>Drugs affecting the peripheral nervous system</b>	4	1	10	6		interviews, control questioning, accounts of classroom practical exercises with oral defense, electronic tests
5.1	Cholinergic drugs			2	1		interviews, control questioning, accounts of classroom practical exercises with oral defense, electronic tests
	Anticholinergic agents	2	0,5	2	1		interviews, control questioning, accounts of classroom practical exercises with oral defense, electronic tests
5.2	Adrenergic drugs			2	1		interviews, control questioning, accounts of classroom practical exercises with oral defense, electronic tests
	Adrenoceptor blocking agent	2	0,5	2	1		interviews, control questioning, accounts of classroom practical exercises with oral defense, electronic tests
5.3	Drugs affecting on afferent transmission of nerve impulses			2	1		colloquium, control questioning, electronic tests
	<b>Final lesson «Drugs affecting the peripheral nervous system»</b>	-	-	2	2	2	interviews, control questioning, accounts of classroom practical exercises with oral defense, electronic tests
6.	<b>Drugs affecting the central nervous system</b>	2	0,5	10	6		interviews, control questioning, electronic tests
6.1	General anesthetics. Ethyl alcohol	-	-	2	1		interviews, control questioning, accounts of classroom practical exercises with oral defense, electronic tests
6.2	Analgesics	2	0,5	2	1		interviews, control questioning, accounts of classroom practical exercises with oral defense, electronic tests
6.3	Anticonvulsants and antiparkinson drugs	-	-	2	1		interviews, control questioning, accounts of classroom practical exercises with oral defense, electronic tests



6.4	Psychotropic drugs	-	-	2	1	interviews, control questioning, electronic tesis
	Final lesson «Drugs affecting the central nervous system»	-	-	2	2	colloquium, control questioning, electronic tesis
7.	<b>Drugs affecting on the function of the executive organs</b>	2	0,5	14	7	
7.1	Drugs affecting on the function of the respiratory system	-	-	2	1	interviews, control questioning, electronic tesis
7.2	Drugs affecting on the function of the digestive system and myometrium contractility	-	-	2	1	interviews, control questioning, electronic tesis
	<b>5 semester</b>					
7.3	Drugs affecting the blood system	-	-	2	1	interviews, control questioning, electronic tesis
7.4	<b>Drugs affecting the cardiovascular system and kidney function.</b> Antihypertensives	2	0,5	8	4	interviews, control questioning, electronic tesis
	Antianginal and lipid-lowering drugs			2	1	interviews, control questioning, electronic tesis
	Drugs for the treatment of heart failure. Antiarrhythmic drugs	2	0,5	2	1	interviews, control questioning, electronic tesis
	Final lesson «Drugs affecting the cardiovascular system and kidney function»			2	1	colloquium, control questioning, electronic tesis
8.	<b>Drugs that regulate tissue metabolism</b>	2	0,5	6	3	
8.1	Hormonal and anti-hormonal agents	-	-	2	1	interviews, control questioning, electronic tesis
8.2	Anti-inflammatory agents			2	1	interviews, control questioning, electronic tesis
8.3	Antiallergic agents and immunomodulators. Vitamins and vitamin-like drugs	2	0,5	2	1	interviews, control questioning, electronic tesis



9.	<b>Chemotherapeutic agents</b>	4	1	12	6
9.1	Chemotherapy infections. Basic concepts. Chemotherapeutic agents	4	1	4	2
	Chemotherapy. Basic concepts. Chemotherapeutic agents. Antibiotics. $\beta$ -lactam and other antibiotics that inhibit cell wall synthesis	2	0,5	2	1
	Antibiotics that violate the permeability of the cytoplasmic membrane. Antibiotics that inhibit protein synthesis. Inhibitors of RNA synthesis.			2	1
9.2	Synthetic antimicrobials. Antimycobacterial drugs	2	0,5	2	1
9.3	Antiviral and antimycotic agents			2	1
9.4	Antiseptics and disinfectants. Antiprotozoal and antiparasitic agents. Anticancer drugs			2	2
	Final lesson «Chemotherapeutic agents»			2	-
<b>10.</b>	<b>Drugs used in dentistry</b>	<b>2</b>	<b>0,5</b>	<b>4</b>	<b>4</b>
10.1	Means regulating metabolism in solid tissues of the tooth, the formulations of phosphorus, calcium and fluoride. Drugs affecting on the regeneration processes	2	0,5	2	2
10.2	Drugs used for impact to the mucosa of the oral cavity and the dental pulp			2	2
<b>11.</b>	<b>Drug-to-drug interactions. Pharmacogenetics</b>	-	-	<b>2</b>	<b>2</b>
<b>12.</b>	<b>The principles of treatment of acute drug poisoning</b>	-	-	<b>2</b>	<b>2</b>
	<b>Total hours</b>	<b>20</b>	<b>6</b>	<b>72</b>	<b>44</b>



## INFORMATION AND INSTRUCTIONAL UNIT

### LITERATURE

#### **Basic:**

1. Kharkevitch, D .A. Pharmacology : textbook for medical students.– 2nd ed., rev.and suppl. – Moscow : GEOTAR-Media Publishihg Group, 2017. – 680 p. – Translation of Russian textbook «Pharmacology» 2017.
2. Alyautdin, R. N. Pharmacology : illustrated textbook / R. N. Alyautdin. - Moscow : Geotar-Media, 2022. - 312 p.

#### **Additional:**

3. Katzung, B. G. Basic and Clinical Pharmacology / B. G. Katzung, A. J. Trevor. - 14th ed. - 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. Knuidering-Hall. - New York : McGraw-Hill Medical, 2019. – 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.
6. Волчек, А. В. Pharmacology : tests for the specialty «Dentistry» = Фармакология тесты для специальности «Стоматология» (на английском языке) / А. В. Волчек. Н. А. Бизунок, Б. В. Дубовик, А. В. Шелухина. – Минск : БГМУ, 2019. – 108 с.

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

#### **The time given 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:**

- preparation and presentation of abstracts;
- presentation of reports;
- 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.

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

test paper;  
final class, colloquium in the form of an oral interview, written work, testing;  
discussion of abstracts;  
checking up abstracts, written reports, accounts, prescriptions;  
individual interview.

**LIST OF AVAILABLE DIAGNOSTIC TOOLS**

The following forms are used for competences assessment:

**1. Oral form:**

interviews;  
colloquiums.

**2. Written form:**

control questioning;  
classroom (home) practical exercises.

**3. Oral-written form:**

accounts of classroom practical exercises with oral defense;  
accounts of home practical exercises with oral defense;  
examinations.

**4. Technical form:**

electronic tests.

**LIST OF AVAILABLE TEACHING METHODS**

Traditional method (lecture, 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 databases and reference guides for medicines.
2. Choice of the method of administration of the drug, its dosing regimen based on the pharmacokinetic data of the drug and the goals of pharmacotherapy.
3. Writing out and issuing a doctor's prescription when prescribing medicines in various dosage forms.

**LIST OF EQUIPMENT USED**

*Illustrative material - tables, pictures, slides:*

1. Absorption.
2. Distribution.



3. Excretion and elimination.
4. Stationary concentration (C<sub>ss</sub>).
5. Pharmacodynamics.
6. Ligand-receptor interaction.
7. Autonomic innervation of the visceral organs.
8. Cholinergic mediation.
9. N-cholinergic blockade and mediation.
10. Adrenergic mediation.
11. Effects of dopamine dopaminergic agents.
12. Serotonin and serotonergic agents.
13. Diuretics.
14. Pharmacodynamics of calcium channel blockers.
15. Pharmacodynamics of organic nitrates.
16. Compensatory response to vasodilation.
17. Principles of antiarrhythmic agents.
18. RAAS inhibitors.
19. Drugs for treatment of heart failure.
20. Pharmacology of hemostasis.
21. Pharmacology of central nervous system.
22. Anticonvulsants.
23. Principles of pharmacotherapy of Parkinsonism.
24. Pharmacology of pain (I part, analgesics).
25. Pharmacology of pain (II part of the "targets").
26. Pharmacotherapy of migraine.
27. Anti-inflammatory agents.
28. Pharmacotherapy of gout.
29. Formation and implementation of allergic reactions.
30. Principles of action of antiallergic agents.
31. Drugs for treatment of diseases of the stomach and duodenum.
32. Anticonstipation drugs.
33. Hormonal and anti-hormonal agents (estrogen).
34. Hormonal and anti-hormonal agents (thyroid).
35. Principles of antibacterial agents.
36. Antiviral agents.
37. Pharmacotherapy malaria.
38. Teaching aids to practical training in pharmacology for students.
39. Guidelines to practical training in pharmacology for teachers.
40. Assignments on general and special recipe.
41. Written assignments to identify the source of knowledge of students in the beginning of class.
42. Materials for independent work of students in order to correct the source of knowledge.
43. Test questions to prepare students for the final classes.
44. Assignments for total employment.
45. Questions to prepare students for the exam.

**LIST OF LECTURES***Semester 4:*

1. Pharmacokinetics of drugs.
2. Pharmacodynamics of drugs.
3. Cholinergic drugs.
4. Adrenergic drugs.
5. Analgesics.
6. Drugs affecting the cardiovascular system and kidney function.

*Semester 5*

1. Anti-inflammatory agents. Antiallergic agents and immunomodulators.
2. Chemotherapeutic agents. Antibiotics.
3. Antimycobacterial drugs. Antiviral and antimycotic agents.
4. Drugs used in dentistry.

**LIST OF PRACTICAL STUDIES***Semester 4*

1. Subject of pharmacology. Terminology. Sources and stages of creation of drugs. Legislation for drugs. Rules for the prescribing drugs in various dosage forms. Solid drug forms.
2. Liquid drug forms.
3. Semi-solid (soft) drug forms. Injectable drug forms.
4. Pharmacokinetics of drugs.
5. Pharmacodynamics of drugs.
6. Final lesson on «Rules for the prescribing drugs in various dosage forms», «Pharmacokinetics of drugs», «Pharmacodynamics of drugs».
7. Cholinergic drugs.
8. Anticholinergic agents.
9. Adrenergic drugs.
10. Adrenoceptor blocking agent. Drugs affecting on afferent transmission of nerve impulses.
11. Final lesson «Drugs affecting the peripheral nervous system».
12. General anesthetics. Ethyl alcohol.
13. Analgesics.
14. Anticonvulsants and antiparkinson drugs.
15. Psychotropic drugs.
16. Final lesson «Drugs affecting the peripheral nervous system».
17. Drugs affecting on the function of the respiratory system.
18. Drugs affecting on the function of the digestive system and myometrium contractility.

*Semester 5*

1. Drugs affecting the blood system.
2. Drugs affecting the cardiovascular system and kidney function. Antihypertensives.



3. Antianginal and lipid-lowering drugs.
4. Drugs for the treatment of heart failure. Antiarrhythmic drugs.
5. Final lesson «Drugs affecting the cardiovascular system and kidney function».
6. Hormonal and anti-hormonal agents.
7. Anti-inflammatory agents.
8. Antiallergic agents and immunomodulators. Vitamins and vitamin-like drugs.
9. Chemotherapy. Basic concepts. Chemotherapeutic agents. Antibiotics.  $\beta$ -lactam and other antibiotics that inhibit cell wall synthesis.
10. Antibiotics that violate the permeability of the cytoplasmic membrane. Antibiotics that inhibit protein synthesis. Inhibitors of RNA synthesis.
11. Synthetic antimicrobials. Antimycobacterial drugs.
12. Antiviral and antimycotic agents.
13. Antiseptics and disinfectants. Antiprotozoal and antiparasitic agents. Anticancer drugs.
14. Final lesson «Chemotherapeutic agents».
15. Means regulating metabolism in solid tissues of the tooth, the formulations of phosphorus, calcium and fluoride. Drugs affecting on the regeneration processes.
16. Drugs used for impact to the mucosa of the oral cavity and the dental pulp.
17. Drug-to-drug interactions. Pharmacogenetics.
18. The principles of treatment of acute drug poisoning.

**PROTOCOL OF THE CURRICULUM APPROVAL  
BY OTHER DEPARTMENTS**

Title of the discipline requiring approval	Department	Amendments to the curriculum in the academic discipline	Decision of the department, which designed the curriculum (date, protocol # )
1. Internal Diseases	Propaedeutics of Internal Diseases	No	protocol # 16 of 29.09.2022
2. Pediatrics	Propaedeutics of Childhood Diseases	No	protocol # 16 of 29.09.2022
3. General clinical module	General Surgery, Eye Diseases, Traumatology and Orthopedics, Obstetrics and Gynecology, Ear, Nose and Throat Diseases	No	protocol # 16 of 29.09.2022
4. General clinical module 2	Forensic Medicine, Psychiatry and Medical Psychology, Clinical Pharmacology, Infectious Diseases, Nervous and Neurosurgical Diseases, Skin and Venereal Diseases	No	protocol # 16 of 29.09.2022
5. Module «Therapeutic dentistry»	Conservative Dentistry, Endodontics	No	protocol # 16 of 29.09.2022
6. Module «Periodontology»	Periodontology	No	protocol # 16 of 29.09.2022
7. Module «Maxillofacial Surgery and Surgical Dentistry»	Maxillofacial Surgery, Oral Surgery	No	protocol # 16 of 29.09.2022
8. Module «Pediatric Dentistry»	Pediatric Dentistry	No	protocol # 16 of 29.09.2022



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

Dean of the Medical Faculty for International Students of the educational institution «Belarusian State Medical University»

16. 11. 2022


O.S. Ishutin


Methodologist of the educational institution «Belarusian State Medical University»


16. 11. 2022


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