

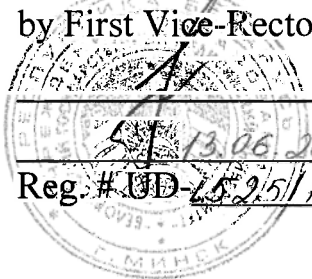
MINISTRY OF HEALTH OF THE REPUBLIC OF BELARUS
EDUCATIONAL INSTITUTION
BELARUSIAN STATE MEDICAL UNIVERSITY

Контрольный
экземпляр

APPROVED

by First Vice-Rector, Professor

S.V.Gubkin



Reg. # UD-4525/1819/edu.

PHARMACOLOGY

Curriculum of higher educational institution
in the educational discipline for the specialty

1-79 01 08 "Pharmacy"

Minsk, BSMU 2018

Curriculum is based on the standard educational program “Pharmacology”, approved on October, 16, 2015, registration # ТД-L.525/type.

COMPILERS:

N.A.Bizunok, D.Sc., Professor;
B.V.Dubovik, D.Sc., Professor;
B.A.Valynets, PhD, Associate Professor;
A.U.Vauchok, PhD, Associate Professor.

RECOMMENDED FOR APPROVAL:

by the Pharmacology Department of the Educational Institution “Belarusian State Medical University”
(protocol # 9a of 15.05.2018);

by the Methodological Commission of Biomedical Disciplines of the Educational Institution “Belarusian State Medical University”
(protocol # 9 of 30.05.2018)

EXPLANATORY NOTE

Pharmacology - science and discipline of the interaction of chemicals with living systems. Pharmacology forms in students understanding of the basic approaches to the management of the vital processes of the human body with drugs, principles and mechanisms of action of drugs, areas of their clinical use, side effects and adverse effects of the use of medicines. At later stages of medical education pharmacology is studied in close connection with clinical medicine as a future doctor has to develop the ability to rationally use drugs tailored to individual manifestations of disease based on analysis of all clinical data.

The program includes the study of general and specific issues of pharmacology with a focus on drugs, which find wide application in practice. The curriculum is aimed at developing students' academic, social, personal and professional competences.

The purpose of teaching and studying the discipline "Pharmacology" is to develop students' fundamental knowledge on modern medicines for treatment of various diseases and correction of pathological states of the human body.

The tasks of teaching the discipline consist in forming student's academic competences, which are based on the ability to self-search educational and information resources, to master the methods of knowledge acquisition and understanding of:

- principles of quantitative regularities and mechanisms of drug action at different levels of biological organization: molecular, cellular, tissue, organ, at the level of functional systems and the whole organism;
- the most important principles of pharmacokinetics of drugs: the processes of absorption, distribution, biotransformation, excretion; principles of rational dosing of drugs, including the selection of the dosage form, route of administration and dosage regimen;
- major pharmacological effects of providing the therapeutic effect of drugs, indications and contraindications, drug interaction problems, their combined use;
- nature of adverse and toxic effects of drugs, as well as ways to minimize the negative consequences of their use;
- rules for the preparation and prescription of drugs in different dosage forms.

The task of teaching consists in shaping the social, personal and professional competences, the foundation of which is the knowledge and application of:

- modeling the mechanisms of interaction of drugs and biological systems at various levels, contributing to the formation of student's clinical thinking and respecting the rules of good laboratory practice, medical ethics and deontology;
- methodological approaches to solving pharmacology problems – search, research and rational justification of the use of new highly effective and safe drugs for practical medicine.

The discipline "Pharmacology" includes three sections: general pharmacology (pharmacokinetics and pharmacodynamics), special pharmacology of different

groups of drugs, general prescription. Objects of study are drugs, their biological effects and therapeutic applications discussed in clinically relevant aspects.

The study of Pharmacology integrates previously acquired knowledge in the field of chemical and biological, structural and physiological basis of life of living organisms, as well as mechanisms for the development of various pathological processes and human diseases, thus solving a new problem – the mastery of pharmacological principles and the ways of control of physiological and pathological processes. The program is designed for high initial educational level of students in the field of natural science and the general professional disciplines:

Human anatomy and physiology. Patterns of functioning of cells, tissues, organs and systems healthy body and mechanisms of their regulation. The role of various signaling molecules in the regulation of cell function and receptor mechanisms of control of physiological processes. The mechanism of intracellular signal transduction pathways and the possibility of its use for the regulation of cell function.

Pathology. Basic laws of development and outcome of the disease. Nature of the processes that underlie most diseases – inflammation, fever, hypoxia, metabolic disorders. Causes and mechanisms of circulatory disorders, respiratory, endocrine and nervous systems, etc., their functioning under pathological conditions and compensatory abilities.

Organic chemistry. Biological Chemistry. Features of chemical organization of the cell, the role of its separate morphological components in cellular metabolism. Lipid peroxidation. Detoxification of xenobiotics. Energy metabolism of the cells, the mechanism of protein biosynthesis. Biochemical processes in the body at the level of organs and tissues. Mechanisms of regulation of metabolism.

Microbiology, virology, immunology. Molecular-biological and microbiological aspects of pathogenicity and virulence of microorganisms, their participation in the infectious process. Hepatitis viruses and oncogenic viruses. Information about immunogenesis, immunopathological states. Mechanisms of anti-infectious protection.

Latin. Grammatical components of the Latin language, forming terms in the pharmaceutical nomenclature, terminology and basics of pharmaceutical formulations, rules of writing out the Latin prescription, proper skills of reading and pronunciation of pharmaceutical terms.

Following the tradition of academic teaching medical pharmacology, the teaching of special pharmacology is built on the systemic principle. Drugs are grouped according to different action on the functional body systems (central and peripheral nervous system, respiratory system, cardiovascular system, digestive tract, etc.) by the principle etiological (chemotherapeutic agents), or belonging to a particular class of pharmacological compounds (hormones, vitamins, etc.). This structure provides a tight continuity of teaching in the study of pharmacology and clinical disciplines. The number of medicines listed in the program is about 500, most of which are included in the national list of essential medicines or their equivalent recommended by the World Health Organization.

The volume of information taught in special sections of pharmacology, includes:

For groups of drugs:

- classification of drugs in this group;
- physiological and biological basis of their action;
- pharmacological action, defining the therapeutic potential of drugs in this group (indications for use);
- the main use in medicine.

For the individual drugs:

- place in the classification;
- basic pharmacological, adverse, toxic effects;
- the main clinical use, indications, routes of administration;
- comparative characteristics among other members of the class.

As a result of studying the discipline “Pharmacology” the student should know:

- nomenclature of medicines;
- legal, economic, organizational and deontological aspects of application of medicines;
- basis of pharmacokinetics and pharmacodynamics of medicines, specific features of their use, depending on the age of the patient;
- pharmacological properties and clinical application of the basic medicines;
- conditions and limitations of using pain medications, methods of preventing drug addiction;
- particular use of medicines in the pediatric practice and their use in medical and preventive work for the prevention and reducing morbidity;
- rules of a clinical study and registration of new drugs;

be able to:

- perform calculations of individual dosing regimen based on pharmacokinetic parameters, drug and clinical features of the patient;
- writing out prescriptions when administering drugs in various dosage forms;
- dispense medicines and make corrections in the dosing regimen based on the altered clearance of drug and distribution in the body, rationally prescribe drugs according to their pharmacological properties and clinical indications;

master:

- the skills for calculating individual dosing regimen of drugs based on pharmacokinetic data and individual features of the patient;
- the skills of correcting the dosing regimen in case of pathological changes in the functions of organs and systems responsible for biotransformation and elimination of drugs or in the combined use of different drugs predicting complications of pharmacotherapy and finding ways to minimize them.

The structure of the curriculum in the educational discipline “Pharmacology” includes three sections, the third section is subdivided into fourteen subsections.

Total number of hours for the study of the discipline is 402 academic hours. Classroom hours according to the types of studies: lectures - 72 hours, laboratory classes – 156 hours, student independent work (self-study) - 174 hours.

Current assessment is carried out according to the syllabus of the specialty in the form of a credit (5 and 6 semesters) and examination (7 semester).

Form of higher education – full-time.

ALLOCATION OF ACADEMIC TIME ACCORDING TO SEMESTERS OF STUDY

Code, the name of specialty	Semester	Number of academic hours					Form of current assessment
		total	In-class	including		out-of-class self-studies	
				lectures	laboratory studies (practical classes and seminars)		
1-79 01 08 «Pharmacy»	5	114	76	22	54	38	credit
	6	108	72	18	54	36	credit
	7	180	80	32	48	100	exam
Total hours		402	228	72	156	174	

THEMATIC PLAN

Section (topic) name	Number of class hours	
	lectures	laboratory classes
<i>1</i>	2	3
5 semester		
1. Introduction. General prescription		9
2. General pharmacology	6	12
2.1. Pharmacokinetics of drugs	4	6
2.2. Pharmacodynamics of drugs	2	3
2.3. Final lesson on «General prescription. General pharmacology»		3
3. Special pharmacology		
3.1. Drugs affecting peripheral nervous system	4	15
3.1.1. Cholinergic drugs	2	6
3.1.2. Adrenergic drugs	2	6
3.1.3. Drugs affecting afferent nerves endings. Final lesson on «Drugs affecting peripheral nervous system»		3
3.2. Drugs affecting the central nervous system (laboratory classes and lectures in 5 semester)	8	18
3.2.1. General anesthetics. Ethyl alcohol.	2	3
3.2.2. Analgetic drugs		3

<i>1</i>	<i>2</i>	<i>3</i>
3.2.3. Anticonvulsants		
3.2.4. Antiparkinsonian drugs	2	3
3.2.5. Anxiolytic and sedative-hypnogenic drugs	2	3
3.2.6. Antipsychotic drugs		3
3.2.7. Antidepressants, normothymic drugs.		
3.2.8. Psychostimulants, nootropic drugs.		
Credit	2	3
3.3. Drugs affecting the functions of effector organs and systems (lectures in 5 semester)	4	
3.3.1. Diuretic drugs (<i>lecture</i>)	2	
3.3.2. Drugs affecting cardio-vascular system (<i>lectures in 5 semester</i>)	2	
3.3.2. 1. Antihypertensive drugs (<i>lecture</i>)	2	
6 semester		
3.2.9. Final lesson on «Drugs affecting central nervous system»		3
3.3. Drugs affecting the functions of effector organs and systems (laboratory classes and lectures in 6 semester)	10	30
3.3.1. Diuretic drugs (<i>laboratory class</i>)		3
3.3.2. Drugs affecting cardio-vascular system (<i>laboratory classes and lectures in 6 semester</i>)	6	12
3.3.2. 1. Antihypertensive drugs (<i>laboratory class</i>)		3
3.3.2.2. Antianginal and other antiischemic drugs. Hypolipidemic drugs	2	3
3.3.2.3. Drugs used for the treatment of heart failure	2	3
3.3.2.4. Antiarrhythmic drugs	2	3
3.3.3. Final lesson on «Drugs affecting the cardiovascular system and kidney renal function»		3
3.3. 4. Drugs affecting blood system	2	3
3.3.5. Drugs affecting the gastrointestinal tract	2	6
3.3.6. Drugs affecting the respiratory system		3
3.4. Vitamin drugs		3
3.5. Hormones	4	15
3.5.1. Hypothalamic and pituitary hormones		3
3.5.2. Thyroid and antithyroid hormone drugs	2	3
3.5.3. Regulators of calcium homeostasis		3
3.5.4. Pancreatic hormones and antidiabetic drugs		3
3.5.5. Adrenocortical hormone drugs		
3.5.6. Sex hormones, their analogues and antagonists	2	3
3.6. Credit		3
3.7. Anti-inflammatory drugs (lecture)	2	

<i>1</i>	<i>2</i>	<i>3</i>
3.8. Anti-gout drugs (lecture)	2	
7 semester		
3.7. Anti-inflammatory drugs, 3.8. Anti-gout drugs (laboratory class)		3
3.9. Immunomodulating drugs	4	6
3.10. Chemotherapeutic drugs	20	33
3.10.1. Bacterial cellular wall synthesis inhibitors	2	3
3.10.2. Inhibitors of microbial protein synthesis	2	3
3.10.3. Inhibitors of RNA synthesis	2	3
3.10.4. Antimycobacterial drugs	2	3
3.10.5. Antifungal drugs	2	3
3.10.6. Antiviral drugs	2	3
3.10.7. Antiprotozoal drugs	2	3
3.10.8. Anthelmintic drugs	2	3
3.10.9. Antiseptics and disinfectants	2	3
3.10.10. Anticancer drugs	2	3
3.10.11. Final lesson on «Chemotherapeutic drugs»		3
3.11. Drug-to-drug interaction	2	3
3.12. Various pharmaceutical products (biologically active supplements, phytopreparations, etc.)	2	
3.13. Homeopathic remedies	2	
3.14. Principles of the treatment of acute drug poisoning. Emergency aid drugs	2	3
Total hours	72	156

CONTENT OF EDUCATIONAL MATERIAL

1. Subject of pharmacology. Terminology. Sources and stages of creation of drugs. Legislation for drugs. Rules for the prescribing drugs in various dosage forms

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.

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.

2. General pharmacology

2.1 Pharmacokinetics of drugs

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.

Bioavailability. Route of administration of drugs in the body: the goals, strengths, weaknesses. Presystemic elimination of drugs. Drug distribution in the body: water areas and cellular compartments. The main pharmacokinetic parameters: clearance, volume of distribution, the constant elimination, half-life; their essence, the definition and quantification of the dimension, the relationship, the value for the mode control drug delivery.

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.

2.2. Pharmacodynamics of drugs

Nature of the biological action of chemicals. Physicochemical (non-electrolyte) action: the chemical nature of the agents, their biological effects and medical applications. Chemical mechanisms of action of drugs. Types of chemical reactions with medicines and basic mechanisms of biological substrates modulating influence of drugs on biological processes.

The concept of receptors in pharmacology. Quantitative laws of drugs. The law of diminishing response of biological systems. General view of the concentration-effect in normal and log-normal coordinates. Terms and concepts of quantitative pharmacology: effect, efficiency, activity, agonist (full, partial) antagonist. Clinical difference concepts potency and efficacy of drugs. Drug interactions. Antagonism: pharmacological, physiological, physicochemical. Character of change of drug effect (activity, efficacy), depending on the type of antagonism. Addiction and potentiation of drug action. Measurement of the effect of drugs (gradual and quantum), their essence and clinical application. Variability and variability of drug action. Hyporesponsiveness and hyperresponsiveness, hypersensitivity, idiosyncrasy. Tolerance and tachyphylaxis. Cumulation. Causes of variability of drug action. Drug dependency.

Types of doses: average and higher therapeutic, single, daily and exchange rate, the introductory (loading) and maintenance dose, toxic dose. Evaluation of drug safety. Therapeutic index and certain safety factor.

Therapeutic, and toxic side effects of drugs. Their nature from the standpoint of the concept of receptors. Effect of drugs on the fetus and the pregnancy. The notion of embryotoxic, teratogenic, fetotoxic action. Therapeutic strategy against adverse and toxic effects of drugs.

2.3 Final lesson on «General prescription. General pharmacology»

3. Special pharmacology

3.1 Drugs affecting the peripheral nervous system

3.1.1. 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*, *aceclidinum*): 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, side effects and contraindications; cholinomimetics poisoning, medical aid. N-cholinomimetics: (*nicotine*, *cytisine*). Nicotine pharmacology and toxicology; nicotinism. Nicotinomimetics use in smoking control. M, N-cholinomimetics (*acetylcholine chloride*, *carbachol*). Pharmacological effects, use in medicine.

Anticholinesterase drugs: a) reversible cholinesterase inhibitors (*neostigmine*, *physostigmine*, *physostigmine*, *donepezil*); b) irreversible cholinesterase inhibitors (organophosphorous compounds) – (*Armin*), insecticides, chemical war gases. Features of organophosphates action. Adverse and toxic effects of anticholinesterases. Treatment of poisoning. Application of cholinesterase reactivators (*pralidoxime mesylate*, *trimedoxime bromide (dipiroxime)*) for organophosphates poisoning. Stimulants of endogenous acetylcholine release: *aminopyridine*. Basic effects. Comparative characteristics of drugs. Indications for use. Use of cholinomimetic and anticholinesterases in medicine.

Anticholinergic agents. M-anticholinergics (M-cholinolytics): *atropine*, *scopolamine*, *ipratropium bromide*, *pirenzepine*. Comparative characteristics of M-cholinergic antagonists on the effect on the eye (the width of the pupil, the value of intraocular pressure, the accommodation), cardiovascular system (automatism, conductivity, BP), the smooth muscles of internal organs, glandular secretion, CNS. Application in medicine: indications for use, side effects, contraindications. Poisoning with M-cholinergic antagonists and medical aid. Ganglioplegic (Nn-anticholinergics): *trimetaphan*, *azametonium bromide*, *mecamylamine*. Localization and mechanism of action. The main effects. Indications for application. Side effects. Curariform agents (muscle relaxants, anticholinergics-Nm): *pipekuronium bromide*, *pankuronium bromide*, *atracurium*, *suxamethonium chloride*. Classification. Mechanisms of action of anti-depolarizing and depolarizing curariform drugs. Application. Possible complications. Antagonists of curariform drugs. Pharmacological effects. Use in medicine. Central cholinolytics: *trihexyphenidyl*, *biperiden*. Pharmacological effects. Application of anticholinergic drugs in medicine.

3.1.2. Adrenergic drugs

Adrenergic signaling. Structure and mechanism of adrenergic synapses of nerve impulse transmission. Regulation of the release of mediators and their metabolism. Heterogeneity of adrenoceptors: α and β -adrenoceptors: localization and effects of pharmacological and physiological stimulation. Extrasynaptic adrenoceptors.

Adrenergic agonists (agonists) – general characteristic, mechanism of action, the main pharmacological effects. The main groups of adrenomimetics: α -adrenomimetics [α_1 -adrenomimetics (*phenylephrine*); α_2 -adrenomimetics (*clonidine*); α_1 - & α_2 -adrenomimetics (*naphazoline*)]; β -adrenomimetics [β_1 -adrenomimetics (*dobutamine*); β_2 - adrenomimetics (*salbutamol*, *salmeterol*); β_1 -, β_2 & β_3 -adrenomimetics (*isoprenaline*)]; mixed (α & β)- adrenomimetics (*epinephrine* – β_1 , β_2 , β_3 , α_1 , α_2 -agonist, *norepinephrine* – α_1 , α_2 , β_1 , β_3 -agonist). Application in medicine: indications, side effects, contraindications.

Adrenoceptor blocking agent. General characteristic, mechanism of action, the main pharmacological effects. Main groups: α -adrenoblockers [α_1 -adrenoblockers (*doxazosin*, *prazosin*); α_2 -adrenoblockers (*yohimbine*); α_1 - & α_2 -adrenoblockers (*phentolamine*, *dihydroergotamine*)]; β -adrenoblockers [β_1 - & β_2 -adrenoblockers (*propranolol*, *nadolol*); β_1 -adrenoblockers (cardioselective) (*metoprolol*, *atenolol*); mixed (α & β)- adrenoblockers (*labetalol*). Application in medicine: indications, side effects, contraindications.

Means of presynaptic action. General characteristic. Classification: sympathomimetics (*ephedrine*); sympatholytic *reserpine*, *guanethidine*. Mechanism of action, the main pharmacological effects. Application in medicine: indications, side effects, contraindications. Dopaminemimetics (*dopamine*).

Use of adrenergic and antiadrenergic drugs in medicine.

3.1.3. 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 medicine.

Final lesson on «Drugs affecting peripheral nervous system»

3.2. Drugs affecting the central nervous system

3.2.1. General anesthetics. Ethyl alcohol

History of the discovery and use of anesthetic drugs. Determination of anesthesia. 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.

The main classes of modern anesthetics. Remedies for inhalation anesthesia: liquid volatiles (*halothane*, *isoflurane*, *enflurane*, *sevoflurane*), gas anesthetics: dinitrogen oxide (*nitrous oxide*). Comparative characteristics of drugs for inhalation anesthesia (activity, the rate of development of anesthesia, effects, effects on the cardiovascular system, fire hazard).

Remedies for not inhaled (intravenous) anesthesia: barbiturates (*sodium thiopental*), not-barbiturate anesthetics (*ketamine*, *propofol*, *propanidide*). Features of action, comparative evaluation (activity, the rate of development of anesthesia, duration of action, the aftereffect), advantages and disadvantages. The notion of the breadth of drug 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*, *radotera*, *esperal apomorphine*).

3.2.2. Analgesics

Conception of the systems of perception and regulation of pain in the body. Nociceptive system, specific and non-specific way of pain sensation; pain mediators.

Antinociceptive system mediators their predecessors. Opiate receptors - localization, heterogeneity (μ -, κ -, δ -, σ -), the effects of their activation.

Narcotic analgesics (opiates) and their antagonists. The main pharmacological effects of opioids, the molecular and cellular mechanisms of action: effects on the central nervous system, cardio-vascular effects, effects on the gastrointestinal tract; urogenital and endocrine effects. Pharmacokinetics of opioids. The main groups of opioids and their characteristics. Opioid receptor agonists: natural opium alkaloids (*morphine, codeine, dihydrocodeine*); diphenylpropylamine (*methadone*); Phenylpiperidines (*trimeperidin fentanyl*). Agonist-antagonists (*pentazocine, nalbuphine*), and partial opioid receptor agonists (*buprenorphine*). Opioid antagonists (*naloxone, naltrexone*). The medical uses of narcotic analgesics (acute and chronic pain, cough, diarrhea, pulmonary edema, premedication in anesthesia, leptoanalgesia). Adverse and toxic effects. Acute poisoning by opioids and assistance measures. Chronic toxicity and drug dependence (morphinism). Treatment of addiction and withdrawal syndrome. Drug interaction of opioids with sedative-hypnotic, antipsychotic, anxiolytic and anticholinergic agents.

Non-narcotic analgesics. Mixed analgesics (opioid and non-opioid) or an unidentified mechanism of action (*tramadol, nefopam*). Analgesics-antipyretics (cyclooxygenase inhibitors) (*paracetamol, acetylsalicylic acid, ibuprofen, ketorolac, metamizol sodium*). Mechanisms of analgesic and antipyretic action. Application in medicine: indications, side effects, contraindications. Comparative characteristics of non-narcotic and narcotic analgesics. Means for correcting malignant hyperthermia - dantrolene. Analgesics combined structure. Spasmoanalgetics *baralgin, spazmolgon*. Combination of analgesics-antipyretics, opioids and other drugs (*benalgine, pentalgine IC, pentalgine-H*).

Drugs used for neuropathic pain syndromes. Migraine. Medications for the relief acute attacks of migraine: narcotic analgesics (*acetylsalicylic acid, paracetamol*), serotonin agonists (5HT₁ receptors) (*sumatriptan*), ergot alkaloids (*ergotamine*), antiemetics (*metoclopramide, domperidone*). For the prophylaxis of migraine: *pizotifen, sodium valproate, cyproheptadine*. Neuralgias: post-herpetic, of trigeminal and glossopharyngeal nerves, etc. – *carbamazepine, phenytoin, benzofurokain*. Use of analgesics in medicine.

3.2.3. Anticonvulsants drugs

Anticonvulsants. Classification. Drugs effective in generalized seizures: tonic-clonic (*sodium valproate, phenytoin, primidone*); myoclonic (*clonazepam, lamotrigine*) and absences (*ethosuximide, sodium valproate*); Drugs effective in partial seizures - *carbamazepine, sodium valproate, gabapentin*. Drugs effective for status epilepticus - *lorazepam, diazepam, clonazepam, phenytoin sodium*. Mechanism of anticonvulsant action of antiepileptic drugs. Especially their destination. Side effects.

3.2.4. Antiparkinson drugs

Agent for the treatment of Parkinson's disease. Classification. Dopaminergic agents (*levodopa, amantadine, selegiline, bromocriptine*). Dopa decarboxylase inhibitor (*carbidopa*) and their use in combination with levodopa (*Nacom*). Central anticholinergics *trihexyphenidyl, biperiden*. Mechanisms of action of antiparkinsonian side effects. Principles of treatment of a extrapyramidal disorders.

Medication for the relief of convulsions - diazepam, clonazepam, magnesium sulfate, means of anesthesia, antipsychotics, muscle relaxants, paracetamol (hyperthermic convulsions). Means to reduce spasticity - tolperizone.

3.2.5 Psychotropic drugs. Anxiolytic and sedative-hypnogenic drugs

General characteristics of psychotropic drugs, Psychopharmacology in medicine, life and social life. The main groups of psychopharmacological agents. Anxiolytic, sedative and hypnotic effects - the essence, the similarities and differences. Chemical classes and pharmacological group of drugs used in psychoneurotic and sleep disorders.

Anxiolytics (tranquilizers). Classification. Benzodiazepines (*alprazolam, lorazepam, phenazepam, chlordiazepoxide, diazepam*), including "daytime" tranquilizers (*oxazepam, medazepam, clorazepate dipotassium*); anxiolytics different chemical structure (*bupirone hydrochloride, meksidol*); benzodiazepine antagonist (*flumazenil*).

Sedative (calming) medicines: phytopreparations of valerian, motherwort, lemon balm; combination drugs (Corvalolum).

Hypnotics (sleeping tablets) drugs: benzodiazepines with marked sedative effect (triazolam, temazepam, nitrazepam, flurazepam); not benzodiazepine derivatives – zolpidem; zopiclone, diphenhydramine, promethazine.

Drugs used in biorhythm disorders (change of time zones) – *melatonin*.

Pharmacokinetics and pharmacodynamics of benzodiazepine drugs and other chemical classes. Neurophysiological and molecular mechanisms of action of anxiolytic and sedative-hypnotics. Pharmacological effects. Adverse and toxic effects. Areas of use of anxiolytics and sedative-hypnotics, restrictions of their use.

3.2.6. Antipsychotic drugs (neuroleptics)

Antipsychotics as a special class of psychopharmacological agents. Idea of neuroplegia. Modern antipsychotic drugs: phenothiazines (*chlorpromazine, trifluoperazine*); thioxanthenes (*flupentixol*); butyrophenone derivatives (*haloperidol, droperidol*); derivatives of other chemical groups (*clozapine, risperidone*) Pharmacokinetics. The mechanism of antipsychotic action. Pharmacological effects. Adverse and toxic effects (effects on the central nervous system, autonomic function, endocrine system). Indications for use.

3.2.7. Antidepressants, normothymic drugs

Antidepressants (tимоаналептики). General characteristics. Classification. Non-selective re-uptake inhibitors, noradrenaline and serotonin: tricyclic antidepressants (*imipramine, amitriptyline*); selective serotonin re-uptake of serotonin (*fluoxetine, sertraline*); selective serotonin re-uptake of norepinephrine (*maprotiline*); atypical antidepressants (*trazadon*). MAO inhibitors: irreversible action (*phenelzine*); reversible action (*moclobemide*). Pharmacokinetics antidepressants. Side effects due to blockade of histamine, muscarinic and α_1 -adrenoceptors. Application in medicine: indications and contraindications. The use of antidepressants in medicine.

Mood stabilizer (anti-manic) drugs. (other lithium carbonate and other lithium salt). Pharmacokinetics and mechanism of action of lithium salts. Application of lithium salts in medicine: indications, side effects, contraindications.

3.2.8. Psychostimulants, nootropic drugs

Nootropics, psychostimulant, toning, analeptic agents. The main groups of neuroprotective drugs, mechanisms of action, pharmacological effects. Means of improving metabolic processes mainly (*piracetam, pyritinol, meclofenoxate*). Means predominantly improving cerebral blood flow (*vinpocetine, nimodipine*). Activators of central cholinergic processes (*donepezil*). Activators of central dopaminergic processes (*memantine*). The use in medicine. Side effects and contraindications.

Psychostimulant agents. Main groups: methylxanthines (*caffeine*); arylalkylamines (*mesocarb, amphetamine*). Molecular mechanisms of action, pharmacological effects. Application in medicine: indications, side effects limitations.

Tonics and adaptogens. Main groups: phytopreparations (*ginseng tincture, tincture lemongrass, eleutherococcus extract liquid*). Preparations of animal origin (*pantocrinum, rantarin*). Mechanisms of action, pharmacological effects, application. Drugs that stimulate primarily the spinal cord – *strychnine, securinine*. Applications in medicine, side effects, contraindications.

Analeptic agents (*doxapram, bemegride, etimizol, niketamid, caffeine sodium benzoate*). Mechanisms of action, pharmacological effects, side effects, indications and contraindications. Application of analeptics in medicine.

Credit.

3.2.9. Final lesson on «Drugs affecting central nervous system»

3.3. Drugs affecting the functions of effector organs and systems

3.3.1. Diuretics

The concept of the diuretic. Classification by preferential localization of actions in the nephron, strength, speed of onset and duration of effect. Preparations and their mechanism of effect of a diuretic. The main groups of diuretics: thiazide and thiazide-like diuretics (*hydrochlorothiazide, chlorthalidone, indapamide*), loop diuretics (*furosemide, torasemide*), potassium-sparing diuretics (*triamterene, spironolactone*), osmotic diuretics (*mannitol*), carbonic anhydrase inhibitors (*acetazolamide*), aquaretics (*demeclodycline*). Other drugs with a diuretic effect: *xanthines, cardiac glycosides, dopamine; uricosuric drugs (indacrinon)*. Side effects of diuretics: aqueous electrolyte disturbances, metabolic complications, general toxic effects. Use of diuretics (hypertension, edema, renal failure, acute intoxication, hyperaldosteronism, glaucoma). Criteria for selection of diuretics (rate of onset and the time of maximum diuretic effect, duration of effect), contraindications to their use.

3.3.2. Drugs affecting the cardiovascular system

Antihypertensives.

The main pharmacological approach to the management of blood pressure. Classification of antihypertensive agents: a) Diuretics: thiazide and thiazide-like diuretics (*hydrochlorothiazide, indapamide*); loop diuretics (*furosemide*), potassium-sparing diuretics (*spironolactone, triamterene*). b). Inhibitors of the renin-angiotensin system (RAS): angiotensin-converting enzyme (ACE) inhibitors (*captopril, enalapril, lisinopril*); antagonists, angiotensin II (AT II) (*losartan, valsartan*). c). Simpatoplegetic drugs: central action (*clonidine, methyl dopa* - α_2 agonists-adrenergic and I_1 -imidazoline receptors, *moxonidine* – selective agonist I_1 -imidazoline

receptors), β -blockers (*propranolol, atenolol, metoprolol*), α -blockers (*doxazosin, prazosin, phentolamine*), mixed blockers (*labetalol, carvedilol*), blockers of adrenergic neurons (*reserpine, guanethidine*), ganglionic (*trimetaphan, azametonium, hexamethonium*). d). Calcium channel blockers (CCBs): vasolytic (*nifedipine, isradipine, amlodipine*), bradycarditic (*verapamil, diltiazem*). e). Vasodilators: arteriolar (*diazoxide, hydralazine, minoxidil*), arteriolar and venous (*sodium nitroprusside*). f). Other antihypertensive agents: serotonin receptor antagonists (*ketanserin*), antispasmodics of myotropic action (*bendazol, magnesium sulfate*).

Remedies for emergency control of blood pressure: drugs for relief of hypertensive crises (*bendazol, diazoxide, clonidine, magnesium sulfate, nifedipine, droperidol, furosemide, azametonium, sodium nitroprusside*) for controlled hypotension (*ganglionic*).

Main applications of antihypertensive drugs, the reasons for their use, mechanisms of action, side effects, dosage regimen, contraindications and precautions for their use. Differences pharmacotherapeutic approaches to the treatment of hypertension and relief of hypertensive crisis. Criteria for selection of drugs to individual therapy of hypertension: (severity of the hypotensive effect, mechanism of action, duration of action, interactions with other drugs, reducing the incidence of complications of hypertension, the possibility of correcting the quality of life, reasonable price).

Antianginal and lipid-lowering drugs.

Determination of antianginal drugs. Causes of myocardial ischemia, principles of action of antianginal drugs and modern strategy pharmacotherapy IHD. Classification of antianginal drugs. Main groups: β -blockers, calcium channel blockers, nitrates and organic nitrate-like drugs: organic nitrates fast (*nitroglycerin, isosorbide dinitrate, isosorbide mononitrate*), and prolonged action: oral, transdermal and buccal forms, tablets, capsules, ointments, creams, plate patches. Sydnominines – *molsidomine*, other antianginal medications: antihypoxants and antioxidants (*nicorandil, trimetazidine, mildronat, ubidekarenon*) drugs reflex action (*validol*). Pharmacokinetics, pharmacodynamics, side effects of antianginal drugs. Comparative characteristics of nitrates, calcium channel blockers, β -blockers to influence the course and prognosis of coronary artery disease. Withdrawal. Nitrate tolerance. Phenomenon "steal" myocardial.

Drugs used in the treatment of myocardial infarction.

Medicines to restore coronary blood flow: antithrombotic, *thrombolytic agents; anticoagulants, antiplatelet agents*. Means for limiting the size of the lesion: *organic nitrates (nitroglycerin)*. Pain relief: *narcotic analgesics, neuroleptics (droperidol)*.

Agent for the treatment complications of myocardial infarction: a) cardiogenic shock - *dopamine, norepinephrine, phenylephrine*; b) cardiac arrhythmia - in antiarrhythmics) acute heart failure - *dopamine, dobutamine, nitroglycerin, sodium nitroprusside, furosemide*.

Hypolipidemics. Lipoprotein classes and types of hyperlipoproteinemia. Classification, mechanism of action, indications and side effects of lipid-lowering drugs. Basic groups lowering drugs: bile acid sequestrants, and drugs that hinder the absorption of cholesterol in the intestine (*cholestyramine, colestipol*), drugs that

reduce the formation of atherogenic lipoproteins (*nicotinic acid and derivatives*). Inhibitors of sterol early phase synthesis (*atorvastatin, simvastatin*), lipoprotein lipase activator (*gemfibrozil, fenofibrate*), antioxidants, inhibitors of LDL oxidation in foam cells (*probucol*), physiological correctors lipid containing essential phospholipids and unsaturated fatty acid content increases HDL (*essentiale, lipostabil*). Comparative characteristics of the effectiveness of lipid-lowering drugs and the main aspects of their clinical application.

Agent for the treatment of heart failure.

Modern principles of pharmacotherapy of heart failure (HF). The main groups of drugs used for the treatment of heart failure:

ACE inhibitors (captopril, enalapril, losartan). Mechanisms of action in heart failure and the pharmacological effects: effects on pre-and afterload, the pressure in the pulmonary circulation, heart rate and cardiac output, the processes of remodeling and prognosis in heart failure. Therapeutic use in chronic heart failure and post-MI to prevent myocardial hypertrophy. Side effects.

β-blockers (metoprolol, carvedilol).

Diuretics (furosemid, digidrohloriazid, indapamid, spironolacton, eplerenon)/ Features of diuretics in heart failure. Effect of diuretics on the quality and length of life, and prognosis of heart failure.

Cardiac glycosides(CG). Digoxin. Sources of getting. The main structural determinants of the pharmacological activity. The mechanism of action of cardiotonic action CG (influence on the strength and heart rate, conduction, excitability, automaticity, bioenergetics infarction, parasympathetic tone, sensitivity to sympathetic stimuli). ECG changes under the influence of CG. The essence of the therapeutic action of the CG in decompensated heart failure (influence on stroke and minute volume of blood, arterial and venous pressure, blood flow velocity, diuresis). Psychotropic action CG. Contraindications to CG. Adverse and toxic effects CG: (arrhythmogenic effect, the effect on the gastrointestinal tract, neurotoxic effects, visual disturbances). Pharmacokinetics CG application. Factors that increase the toxicity of the CG (hypokalemia, alkalosis, hypoxia, hypercalcemia, hypomagnesemia, hypothyroidism, hyponatremia), drugs (verapamil, quinidine, glucocorticosteroids, thiazide and loop diuretics). Therapy digitalis intoxication (*unitiol, potassium chloride, Na₂EDTA*), antiarrhythmics (*lidocaine*), fragments of specific antibodies.

Non-glycoside drugs with positive inotropic effects (cardiac pacemakers): β-agonists (dopamine, dobutamine), phosphodiesterase inhibitors (milrinone), theophylline (aminophylline, teopek). Mechanisms of inotropic action of cardiac pacemakers, features of use in heart failure.

Antiarrhythmic agents.

Concept of antiarrhythmics. Classification. Tools used in tachyarrhythmias: A. Stabilizers membranes (fast Na channel blockers) prolonging ERP (*quinidine, procainamide*); ERP shortening (*lidocaine, phenytoin*); little effect on the ERP (*flecainide, etatsizin*); B. β-blockers (*propranolol, atenolol, metoprolol*). C. Means prolonging repolarization phase and the action potential (*amiodarone*). D. Blockers Ca⁺⁺ channel (*verapamil*). Drugs used in bradyarrhythmia: M-anticholinergics

(*atropine*), adrenergic agonists (*isoprenaline*). Indications and contraindications to the use of antiarrhythmics, side effects.

3.3.3. *Final lesson on «Drugs affecting the cardiovascular system and kidney renal function»*

3.3.4. *Drugs affecting the blood system*

Causes anemia, anemia principles of pharmacotherapy. Agent for the treatment of anemia. Drugs used for the treatment of iron deficiency (hypochromic) anemia: drugs for oral Fe (*iron sulphate and iron lactate*), iron preparations for parenteral administration (*iron sucrose complex III*), Fe combination preparations with folic acid, ascorbic acid, vitamin B12 and other components (*fefol, ferroplex*). Poisoning by drugs Fe, antidotes (*deferoxamine*). Agents used in megaloblastic (*hyperchromic*) anemia (*cyanocobalamin, folic acid*).

Causes leukopenia, principles of pharmacotherapy and prevention of leukopenia. Stimulating agents of leukopoiesis: colony-stimulating factors (*molgramostim, filgrastim*) pyrimidine derivatives (*metiluratsil, pentoxyl*).

Depressants hematopoiesis: depressing erythropoiesis - a solution of *radioactive sodium phosphate*, which suppress erythropoiesis and leukopoiesis - anticancer drugs (*cyclophosphamide, novembihin*).

Principles of treatment and prevention of acute arterial and venous thrombosis. Drugs affecting hemostasis. Antiplatelet agents: drugs acting on the arachidonic acid metabolism inhibitors of cyclooxygenase - *acetylsalicylic acid, ticlopidine* and other NSAIDs (*ibuprofen, naproxen*); thromboxane synthesis inhibitors - *dasoxyben*); drugs that increase the content of cAMP in platelets (phosphodiesterase inhibitors - *dipyridamole, pentoxifylline*, adenylate cyclase stimulators - *epoprostenol*). Anticoagulants. direct action (for parenteral use) heparin (*heparin sodium, nadroparin calcium, sodium enoxaparin*) plasma preparations (*antithrombin III*). Indirect action (oral) - *warfarin, phenindione, acenocoumarol*. Heparin antagonist - *protamine sulfate*. Thrombolytic drugs (fibrinolytics): direct action (*fibrinolysine*), indirect (*streptokinase, tissue plasminogen activator (tPA)*) and recombinant forms of tPA (*alteplase, reteplase*).

Hemostatic agents: stimulators of platelet aggregation (agregants) (*etamzilat, carbazochrome, calcium salts*), indirect coagulants (drugs vitamin K - (*menadione, phytomenadione*), inhibitors of fibrinolysis (*aminocaproic and tranexamic acid*), plasma proteinase inhibitors (*aprotinin, ovomarin* (Belarus)), plasma preparations (*blood coagulation factor VIII, a clotting factor IX*), the means of local action to stop bleeding (*thrombin, tachocomb, beriplast, hemostatic sponge (gelaspon) alufer* (Belarus), *fibrin film isogenic, gelplastan*).

Drugs lowering vascular permeability (*ascorbic acid, rutin*).

3.3.5. *Drugs affecting on the function of the digestive system*

General characteristics of the drugs used for the correction of disturbed functions of the digestive system. The main classes of pharmacological agents used for this purpose, their mechanism of action, pharmacological effects, side effects, application.

Anti-ulcer drugs. Drugs decrease the activity of acid-peptic factor. Antacids: aluminum and magnesium containing antacids (*aluminum hydroxide, magnesium hydroxide*); Combined antacids: *aluminum-magnesium complexes (almagel, gastal)*; *dimethicone-containing antacids (maalox plus)*. *Sodium bicarbonate*. The neutralizing activity, speed and duration of antacid action. Side effects of antacids. Proton pump blockers (*omeprazole*). Histamine H₂-receptor antagonists (*famotidine, ranitidine*). M₁-selective anticholinergics (*pirenzepine*). Prostaglandin analogs (*misoprostol*). Gastrin receptor blockers (*proglumide*). Drugs providing a protective effect on the mucous membrane of the stomach and intestines (gastroprotectives), drugs, forming a protective layer on the surface of ulcers (*bismuthi trikalii dicitras, sucralfate*). Formulations for eradication of *Helicobacter pylori* (*omeprazole, ranitidine bismuth citrate, metronidazole, clarithromycin, amoxicillin*). Reparants (*solkoseril, gastrofarm, sea buckthorn oil, anabolic steroids (retabolil, vitamin A, U, dalargin)*).

Drugs affecting on the tone and motility of the gastrointestinal tract. Drugs that reduce tone and motility: anticholinergics (*dicycloverine, atropine, hyoscine butylbromide*), antispasmodics myotropic action (*drotaverin, papaverine hydrochloride, mebeverin*). Antidiarrheals: opiate receptor agonists (*loperamide, diphenoxylate*), adsorbing agents (*activated carbon, ion exchange resins, diosmektit*), astringents (*oak bark, bilberry fruits, herb hypericum, chamomile flowers, sage leaves*). Stimulants motor: cholinomimetics (*neostigmine*), dopamine receptor antagonists (*metoclopramide*). Laxatives: means for causing chemical irritation of the intestinal mucosa receptors (preparations of *senna, rhubarb, castor oil, phenolphthalein*) means for causing the mechanical stimulation of the receptors of the intestinal mucosa [drugs with osmotic properties (*magnesium sulfate, sodium sulfate, lactulose*); drugs that increase the volume of the contents of the intestine (*methylcellulose*); means softening the stool (*vaseline oil*)]. Localization rate of onset of action and a laxative effect. Indications and contraindications to the use of laxatives. Antiflatulents: preparations (*fennel fruit, fragrant fennel, cumin*), synthetic drugs (*dimethicone, simethicone*).

Emetics and antiemetics. Emetics: *apomorphine, hypertonic solution of sodium chloride (15%)*. Antiemetics: S₃-serotonin receptors (*ondansetron*), blockers of dopamine D₂-receptors (*metoclopramide, domperidone*), blockers of histamine H₁-receptor (*promethazine*), a means to combat motion sickness syndrome (*hyoscine hydrobromide, Table. "Aeron"*), other antiemetic drugs (*nabilone, dexamethasone*). The choice of drug depends on the cause and mechanism of vomiting and the features it antiemetic action.

Hepatotropic agents. Cholagogue: cholesecretics [drugs bile acid (*dehydrocholic acid, allohol*), synthetic cholcretics (*osalmid*), preparations (*corn silk, sandy immortelle*) hydrocholcretics (*mineral water*)] cholecinetics [true cholecinetics (*cholecystokinin, magnesium sulfate*), antispasmodics (*drotaverin, papaverine hydrochloride*), M-anticholinergics]. Hepatic protectors: *methionine, essentielle, silibinin*. Cholelitolitic means (*ursodeoxycholic acid*).

Drugs affecting on the function of the pancreas. Insulin secretagogues - *hydrochloric acid diluted*. Means of substitute therapy (*pancreatin panzinorm, festal*).

Funds depressing secretion (*M-anticholinergics, antacids*). Proteolysis inhibitors - *aprotinin*. Diagnostic tools - *secretin, cholecystokinin*. Basic principles of pharmacotherapy of acute and chronic pancreatitis.

Drugs affecting on appetite and digestion. Antianorexic drugs (increase appetite): reflex action (*tincture of wormwood, plantain juice*), the central action (*cyproheptadine*); stimulating anabolic processes (*insulin, anabolic steroids*). Tools to improve the processes of digestion enzyme preparations (pepsin, tilactase, hydrochloric acid), a combination of enzymatic and acidic drugs (*atcidin-pepsin, gastric juice*). Preparations for the treatment of obesity. Agents acting on the gastrointestinal tract: antienzymes (*orlistat*); bulking intestinal contents (*methylcellulose*). Anorectics central action: norepinephrine reuptake inhibitors and serotonin (*sibutramine*); sympathomimetics (*phenylpropanolamine, phentermine, dexfenfluramine and phentermine*); limitations and dangers of their use; oral hypoglycemic agents (*metformin, acarbose*). Side effects of anorectics.

3.3.6. *Drugs affecting on the function of the respiratory system*

Drugs used for the treatment of bronchial asthma. General principles of treatment of bronchial asthma and the relief of asthmatic attacks. The main classes of pharmacological agents used in asthma, mechanism of action, the main pharmacological effects, side effects, contraindications. Adrenergic agonists: selective β_2 -agonists (*salbutamol, salmeterol*), other agonists (*isoprenaline ephedrine, epinephrine (adrenaline)*). M-anticholinergics (*ipratropium bromide*). Theophylline preparations: for relief of asthma attacks (*aminophylline*) and long-acting (*eufilong*) antiallergic inhibitors release of allergic mediators (*cromoglicic acid*) receptor antagonists leukotrien receptors (*zafirlukast*). Glucocorticoids (*beclomethasone, fluticasone*). Combined bronchodilators: *salbutamol + cromoglicic acid (Ditek)*. Other remedies for asthma, antihistamines, hyposensitizing means (*allergen extracts*), *methotrexate*, etc The choice of drug for individual pharmacotherapy of bronchial asthma, asthmatic relief or prevention.

Respiratory stimulants and surfactants: stimulants of the respiratory center (*bmegrade, etimizol, doxapram hydrochloride*); surfactants (*kolfostseril palmitate*) and their synthetic stimulants (*ambroxol*).

Expectorants and mucolytics: means for facilitating expectoration reflex action (*termopsis drugs, marshmallow, licorice*); resorptive action (*potassium iodide, thyme herb, anise, eucalyptus oil*); means reducing the viscosity and elasticity of sputum synthetic mucolytic means (*bromhexine, ambroxol, acetylcysteine*); enzymatic preparations *dornase alpha, deoxyribonuclease*.

Antitussives. Classification: centrally acting a) narcotic antitussive (*codeine*), b) non-narcotic antitussives (*glaucine, okseladin*); peripherally acting agents (*prenoxdiazine, pronilid*).

Drugs used in the treatment of pulmonary edema. Narcotic analgesics (*trimepiridin, morphine, fentanyl*), neuroleptics (*droperidol, haloperidol*), diuretics (*furosemide, mannitol*), inotropes (*dobutamine, dopamine, digoxin*), glucocorticosteroids (*prednisone, hydrocortisone*), nitrates and nitrate-like drugs

(*nitroglycerin, isosorbide dinitrate*) ganglioplegic (*azametonium*) PDE inhibitors (*aminophylline*), defoamers (*ethyl alcohol*).

3.4. Vitamins and vitamin-like drugs

The biological role of vitamins. History of the discovery. Classification. Consequences of insufficient (hypovitaminosis) and excess (hypervitaminosis) intake (administration) of vitamins in the body. Causes of hypovitaminosis. Stage pathogenesis of vitamin deficiency. Types of vitamin therapy.

Vitamin preparations. Their sources. Classification. Preparations of water-soluble vitamins (*thiamine, benfotiamine, riboflavin, flavinat, calcium pantothenate, folic acid, nicotinic acid, pyridoxine, tsianokobolamin, ascorbic acid, rutin, quercetin*). Metabolic role of vitamin B. Effect on carbohydrate, lipid and protein metabolism. Participate in redox processes. Effect on the nervous, cardiovascular system, gastrointestinal tract, blood, condition epithelium, regeneration processes. Participation of ascorbic acid in the redox processes, the effect on vascular permeability. Therapeutic applications. Effect of *rutin* and *quercetin* on permeability of tissue membranes. Sources of its receipt. Application.

Preparations fat-soluble vitamins (*retinol, ergocalciferol, phytomenadione, menadione, tocopherol*) The biological role of fat-soluble vitamins. Effect of *retinol* on the synthesis of rhodopsin (visual purple), the function of the epithelium of the skin. *Ergocalciferol* and *cholecalciferol* effect on calcium and phosphorus metabolism. Risk of hypervitaminosis with uncontrolled use of these vitamins. Role *phyloquinone* (vitamin K) in the blood clotting process. Application. The biological role of tocopherol impact on the process of lipid peroxidation. (antioxidant activity). Vitamin-like drugs compounds (*choline chloride, calcium pangamat, metilmetioninsulfoniya chloride, inosine*). Multivitamin and a combination of drugs ("*Undevit*", "*Centrum*", "*Supradin*"). The notion of Antivitamins.

3.5. Hormonal and anti-hormonal agents

Hormonal preparations, their synthetic analogues, substitutes and antagonists. Sources of getting. Principles of biological standardization and dosing. Classification.

3.5.1. Hormone medications hypothalamus, pituitary, pineal gland

Preparations hypothalamic hormones and their synthetic analogues: *sermorelin; octreotide, gonadorelin*; Effect of hypothalamic hormone secretion of anterior pituitary hormones. Application in medicine.

Preparations of anterior pituitary hormones and their synthetic analogues (*somatropine, tetracosactide, menotropins, thyrotropin alfa*), Effect of anterior pituitary hormones on the activity of the endocrine glands. Used in medical practice. Antagonists of anterior pituitary hormones: growth hormone receptor antagonist (*pegvisomant*), prolactin inhibitor (*bromocriptine*), an inhibitor of gonadotropin-releasing hormone release (*danazol*).

Formulations posterior pituitary hormones and their synthetic analogues: *oxytocin, vasopressin, desmopressin*. Use of oxytocin in obstetric practice. Antidiuretic properties of vasopressin, effect on the tone of the intestines and blood vessels. *Desmopressin and vasopressin*. Prolactin inhibitor *bromocriptine*.

Hormone drugs of epiphysis (*melatonin*). Physiological role and use of *melatonin*.

3.5.2. Thyroid and antithyroid hormone drugs

Thyroid and antithyroid drugs. Preparations of thyroid hormones: *levothyroxine sodium (T₄)*, *liothyronine (triiodothyronine gidrochlorin (T₃))*. Effect of levothyroxine sodium and triiodothyronine on metabolism. Therapeutic use. Antithyroid agents: thioamides – *tiamazol (mercazolilum, propylthiouracil)*, iodine (*iodine alcohol solution, radioactive iodine*), β -adrenoceptor blocking agent (*propranolol*), blockers of Ca⁺⁺ channels. The mechanism of action of antithyroid thioamides, iodine preparations and other antithyroid agents. Application. Side effects.

3.5.3. Regulators of calcium homeostasis

Hormonal regulators of mineral homeostasis and other drugs affecting bone metabolism. Preparations of parathyroid hormone (*parathyroidin, teriparatide*). Anti-parathyroid agents (*calcitonin*). Bisphosphonates (*alendronate, risedronic acid*). Mechanism of action. Application of hormonal agents in medicine.

Drug parathyroid hormone (*parathyroidin*). The effect on calcium and phosphorus balance. Application.

3.5.4. Pancreatic hormones and antidiabetic drugs

Hormonal agents and pancreatic synthetic antidiabetic agent. Insulin preparations. *Human insulin: insulin lispro, insulin human, insulin zinc suspension component, isophane insulin, insulin zinc suspension (crystalline)*. Insulin of animal origin *insulin neutral injectable insulin zinc suspension component*. Effect of insulin on the metabolism. Principles of its dosing in the treatment of diabetes. Formulations of insulin with prolonged action. Preparations of recombinant human insulin.

Oral hypoglycemic agents: sulfonyleureas (*glibenclamide, glipizide*); biguanides (*metformin*). Mechanism of action of synthetic hypoglycemic agents for oral administration. Comparative evaluation of synthetic insulin and hypoglycemic agents. Indications. Side effects.

Other antidiabetic agents: agents that increase tissue sensitivity to insuline (*pioglitazone*); stimulators of insulin release (*repaglinide*). Antagonists of insulin (*glucagon, epinephrine, corticosteroids*). The mechanism of action and their use.

3.5.5. Adrenocortical hormone drugs

Preparations of adrenal hormones. Glucocorticosteroids: *hydrocortisone, methylprednisolone, prednisolone, triamcinolone, dexamethasone, betamethasone, flyumetazone pivalate, fluocinolone acetamide (sinaflan), mometasone*. Classification. Glucocorticoid effects on the metabolism of carbohydrates, proteins, fats, salts, water, pigments. Anti-inflammatory and anti-allergic properties of glucocorticoids. Therapeutic applications. Complications. Synthetic glucocorticoids for topical application [*fluocinolone acetamide (sinaflan), mometasone*]. Features of their chemical structure. Mineralocorticoids (*dezoksikorton, fludrocortisone*). Biological effect and application of mineralocorticoids. Corticosteroid synthesis inhibitors (*aminoglutethimide*).

3.5.6. Sex hormones, their analogues and antagonists

Preparations of female sex hormones. Estrogenic drugs steroid structure (*estradiol, ethinyl estradiol*); non-steroidal structure, (*diethylstilbestrol*); selective estrogen receptor modulators (*raloxifene*). Progestin drugs (*progesterone, medroxyprogesterone*). The physiological role of estrogens and progestogens. Preparations for enteral or parenteral application. Long-acting progestin (*oxyprogesterone capronate*). The therapeutic use of estrogens and progestogens. Antagonists of estrogen and progestin (*tamoxifen, mifepristone*). Application in medicine.

Contraceptives. Contraceptives for oral administration: monophasic (*silest, marvelon, regulon*); biphasic (*anteovin*); three-phase (*three-merci, three-regolith*); containing only progestin (*norethisterone*). Implantable depot forms (*levonorgestrel (Norplant)*). Postcoital contraceptives («morning after») (*levonorgestrel*). Operating principles of contraceptives. Application. Side Effects.

Preparations of male sex hormones, anabolic steroids, hormonal regulators of mineral metabolism. Androgenic drugs and their antagonists (*testosterone, methyltestosterone, mesterolone*). Effects on the organism. Preparations for enteral or parenteral application. Long-acting drugs (*testenat*). Indications for use. Adverse effects. Antiandrogen drugs (*flutamide*). The mechanism of action. Application in medicine.

Anabolic steroids (*nandrolone, oxandrolone, stanozol, silabolin*). Effect of anabolic steroids on the metabolic processes. Indications and contraindications for use. Side effects.

Credit.

3.7. Anti-inflammatory agents

Glucocorticosteroids (GCS), *prednisolone, methylprednisolone, triamcinolone, dexamethasone, betamethasone, fluocinolone acetonide*. Classification of GCS. Mechanisms of anti-inflammatory effect (effect on cell membranes and lysosomes, formation of arachidonic acid metabolites (phospholipase A₂), vascular permeability, leukocyte migration, energy supply off inflammation). Pharmacological effects. Indications and contraindications for use. Side effects and their prevention.

Nonsteroidal antiinflammatory drugs (NSAIDs), *acetylsalicylic acid, diflunisal, mefenamic acid, diclofenac, indomethacin, sulindac, etodolac, phenylbutazone, piroxicam, nabumetone, meloxicam, nimesulide, celecoxib, rofecoxib, artrotek, misoprostol*. Classification of NSAIDs. Mechanisms of anti-inflammatory effect (effect on inflammatory cells and mediators, the processes of prostaglandin synthesis (COX-1 and COX-2), monoamines, kinins, fibroblast proliferation, synthesis of acid mucopolysaccharides on the transcription factor NF- κ B, cartilage metabolism). Pharmacological effects of NSAIDs, indications, side effects (effects on the gastrointestinal tract, the kidneys, central nervous system, bronchi), measures of prevention.

3.8. Anti-gout drugs

As uric acid synthesis inhibitors (allopurinol) urikosuric agents (sulfapyrazone, probenecid); drugs used in acute gout attacks: NSAIDs, GCS, colchicine. The mechanisms of action, use, side effects.

3.9. Immunomodulating drugs

Antiallergic agents. Concept and classification of antiallergic agents. Means, used for immediate type allergic reactions glucocorticosteroids (GCS). GCS Classification: short-acting (*hydrocortisone, prednisolone, methylprednisolone*); average duration (*triamcinolone*); long-acting (*dexamethasone, betamethasone*); glucocorticoids for local and external use (*fluticasone, beclomethasone, budesonide, mometasone, fluocinolone acetonide*). Mechanisms antiallergic effect: effects on cells and mediators of allergy, including the processes of synthesis of prostaglandins and leukotrienes; FC-receptor on the surface of mast cells, basophils, macrophages and other cell elements mesenchyme; Active components of the complement system (C3-C8); cooperation of T-and B-lymphocyte migration of leukocytes. Indications and contraindications for use. Leukotriene receptor antagonists: *zafirlukast, montelukast*. Mast cell stabilizers: *cromoglicic acid, nedocromil, ketotifen*. Antihistamines: H₁-blockers of histamine receptors [first generation (*diphenhydramine, promethazine, clemastine, hifenadin*); second generation (*loratadine, fexofenadine, cetirizine, levocabastine*); H₁-histamine blockers receptors anti-serotonin agents (*cyproheptadine*)]; Inhibitors of the action of allergic mediators (*fenspiride*). The mechanism of action. Comparative characteristics. Adverse effects. Application.

Antiallergic action of preparations theophylline (*aminophylline, teotard, eufilong*) and adrenomimetics (*adrenaline, ephedrine, salbutamol*), their use in medical practice.

Agents used in anaphylactic shock (*adrenaline, glucocorticosteroids, antihistamines, dopamine, aminophylline*) Principles of their actions.

Agents used in delayed hypersensitivity (autoimmune diseases, tissue incompatibility). Basic antirheumatic drugs (slow-acting): *gold salts (auranofin); penicillamine; aminoquinolines (chloroquine); sulfasalazine*. Immunosuppressants: selective immunosuppressants which inhibit the expression or action of interleukin-2 (*cyclosporine, tacrolimus, sirolimus*), antilymphocyte immunoglobulins, monoclonal antibody preparations (*basiliximab, daclizumab*); cytotoxic agents (*azathioprine, methotrexate, leflunomide, cyclophosphamide*).

Immunomodulators. Immunomodulators exogenous origin: a) microbial (*IRS-19, bronhomunal, ribomunil*); b) plant (*echinacea drugs (immunal); phytopreparations combined structure (ehingin, trimunal)*). Immunoregulatory peptides of endogenous origin: *interferon gamma, betaleukin, aldesleukin*. Synthetic immunomodulators: *timogen inosine pranobex, tilorone* (interferonogen). Mechanisms of action of immunomodulators (effects on cells of the monocyte-macrophage system, T-and B-lymphocytes, cytokine, antibody). Use of immunomodulators in medicine.

3.10. Chemotherapeutic agents

Chemotherapy infections. Basic concepts. Chemotherapeutic agents. Definition, general characteristics, classification. Anthology of discovery and use of antimicrobial agents. Antibiotics. The biological significance of antibiotics (work D.L.Romanovsky, P. Ehrlich, G. Domagk, A.Fleming, G. Flory, E. Chain, ZV Yermolyeva, S. Waxman). The role of antibiotics in medicine and biology.

Basic concepts in the field of chemotherapy of infections: empirical (probability) antimicrobial therapy, combined antimicrobial therapy, antimicrobial chemoprophylaxis; antibiotic, probiotic (eubiotic); bactericidal/bacteriostatic effect; selection means (first-line drugs, plant and equipment), backup (second-line drugs, alternative remedies); minimum inhibitory (overwhelming) concentration, minimum bactericidal concentration; postantibiotic effect; sensitivity/resistance of the pathogen; nosocomial infection, superinfection, mixed infection, goiter. Essence of pharmacodynamic differences and chemotherapeutic properties. Modern sources of creation and future directions of antimicrobial agents. Criteria and the basic principles of rational chemotherapy infections. Clinical and microbiological evidence to determine susceptibility to antibiotics. Combination antibiotic therapy. Rational combinations of antimicrobial agents. Critical analysis of the possible reasons for the ineffectiveness of antimicrobial therapy. Understanding Properties "ideal" antimicrobial agent, as criteria for evaluating new drugs for the treatment of infections. Principles of classification of antibiotics. The basic mechanisms of action of antibiotics. Side effects and complications of antibiotic therapy, prevention and treatment. Microbial resistance to antibiotics; mechanisms and ways to overcome.

3.10.1. Bacterial cellular wall synthesis inhibitors

Antibiotics. β -lactam and other antibiotics that inhibit cell wall synthesis (bactericidal). β -lactam antibiotics: penicillins a) biosynthetic penicillins: for parenteral administration: *benzylpenicillin (Na and K salts)*, *penicillin G procaine*, *benzathine penicillin G (Bicillin -1)*; for oral use: *phenoxymethylpenicillin* b) anti-staphylococcal penicillins resistant to β -lactamases: *oxacillin*, *flucloxacillin*, *cloxacillin*; c) aminopenicillins (broad spectrum): *amoxicillin*, *ampicillin*; d) karboxypenicillins: *carbenicillin*, *ticarcillin*; e) ureidic-penicillins: *piperacillin*, *azlocillin*; f) mecillinams: *pivmetsilinam*; g) a combination of penicillins with inhibitors β -lactamases: *amoxiclav (amoxicillin + clavulanate potassium)*; *unazin (ampicillin + sulbactam)*; *tazocin (piperacillin + tazobactam)*.

Cephalosporins and cephamycins. Classification of cephalosporins in the spectrum of antimicrobial activity, resistance to β -lactamases and route of administration (parenteral/inside): I-th generation (*cephradine*, *cefazolin*, *cephalexin*); II-generation (*cefuroxime*, *cefoxitin*, *cefamandole*, *ceftaxime*, *cefuroxime axetil*); III-generation (*cefotaxime*, *ceftazidime*, *ceftazidime*, *ceftriaxone*, *cefixime*, *cefepime*); IV-th generation (*cefepime*, *ceftazidime*); combination of drugs with cephalosporins β -lactamase inhibitors: *sulperazon (ceftazidime + sulbactam)*. Carbapenems: *imipenem*, *meropenem*. Monobactams: *aztreonam*. Glycopeptides *vancomycin*, *teicoplanin*.

Antibiotics that violate the permeability of the cytoplasmic membrane (bactericidal). Polypeptides: *polymyxin M*, *colistin*. Polyenes: *nystatin*, *amphotericin B*.

3.10.2. Antibiotics that inhibit protein synthesis (bacteriostats)

Aminoglycosides (aminocyclitols) - bactericidal (exception): first generation (*streptomycin*, *neomycin*); second generation (*gentamycin*); third generation (*amikacin*, *netilmicin*, *tobramycin*). Tetracyclines: biosynthetic (*tetracycline*,

oxytetracycline); semisynthetic (*doxycycline, minocycline*). Macrolides and azalides: a 14-membered ring (*erythromycin, clarithromycin, telithromycin*); with a 15-membered ring (azalides) (*azithromycin*); with a 16-membered ring (*spiramycin*). Amfenikoles: *chloramphenicol*. Lincosamides: *clindamycin, lincomycin*. Antibiotics steroid structure: *fusidic acid*. Oxazolidinones: *linezolid*.

3.10.3. Inhibitors of RNA synthesis

Antibiotics inhibit the synthesis of RNA (bactericidal). Ansamycins: *rifampin, rifabutin. Griseofulvin (antifungal antibiotics)*.

Synthetic antimicrobials. History of the discovery and development of sulfonamides sulfanilamide therapy. Classification according to the location and duration of action: Sulphonamides with systemic action: a) a short action (*streptocide sulfadimidine*); b) The average duration of action (*sulphadiazine*); c) long-acting (*sulfamethoxyipyridazine, sulfadimetoksin, sulfadoxine*); d) over a long-acting (*sulfalen*); e) a combination of sulfonamides and trimethoprim: *cotrimoxazole, sumetrolim*. Mechanisms for increasing and enhancing the antimicrobial activity spectrum. Sulfonamides, acting in the intestine: *ftalilsulfatiazol, ftalilsulfapiridazin*; salasine-sulfonamides (*sulfasalazine*). Topical sulphonamides: *sulfacetamide, sulfadiazine silver mafenid*. Hydroxyquinoline: *nitroksolin, hlorhinaldola*. Nitrofurans: *nitrofurantoin, furazolidone*. Quinolones: *nalidixic acid, oxolinic acid, pipemidic acid*. Fluoroquinolones: *norfloxacin, ciprofloxacin, ofloxacin, levofloxacin, moxifloxacin*. Nitroimidazoles: *metronidazole, tinidazole*. Pharmacokinetics and pharmacodynamics of synthetic antimicrobial drugs. Indications for use, side effects, contraindications.

3.10.4. Antimycobacterial drugs

Antituberculosis drugs. Basic drugs: isoniazid, rifampicin, pyrazinamide, ethambutol, streptomycin. Reserve drugs: capreomycin, kanamycin, amikacin, protionamid, cycloserine, fluoroquinolones, azithromycin, clarithromycin, rifabutin, thioacetazone, clofazimine, para-amino salicylic acid. The mechanism of antibacterial action. Absorption, distribution, biotransformation and excretion. Side effects. Features of application of anti-TB drugs (duration of treatment of combination therapy).

3.10.5. Antifungal drugs

Antifungal antibiotics – *amphotericin B, nystatin; griseofulvin*. Imidazole derivatives: systemic and topical – *ketoconazole, miconazole*; topical - *clotrimazole, bifonazole, econazole*. Triazole derivatives: *fluconazole, itraconazole*. Antifungals different chemical classes: *flucytosine, terbinafine, ciclopirox*. Pharmacokinetics and pharmacodynamics of antimycotic drugs, indications, contraindications, side effects and toxic.

3.10.6. Antiviral drugs

Classification of antiviral agents. 1. Inhibitors adsorption, penetration and "undressing" viruses: influenza and equipment - (*amantadine, rimantadine*) *gamma globulin against measles, hepatitis B and C, rabies, cytomegalovirus infection*. 2. Inhibitors of intracellular synthesis of viral components. Inhibitors of the synthesis of

nucleic acids: antiherpethetical drugs - *acyclovir*, *idoxuridine*, *foscarnet*; drugs for the treatment of HIV infections (reverse transcriptase inhibitors) - *zidovudine*, *zalcitabine*, *nevirapine*; protease inhibitors - saquinavir; anti-CMV drugs - *ganciclovir*, *valganciclovir*, *foscarnet*; drugs used in respiratory syncytial infection - *ribavirin*, *palivizumab*. Inhibitors of the synthesis of late viral RNAs and proteins: interferons - *interferon α* , *interferon α -2a*, *interferon α -2b*, *interferon beta*, *interferon gamma-1b*; interferonogens - *tilorone*, *arbidol*; synthesis inhibitors of late viral proteins - *metisazon*. Inhibitors of self-assembly - *rifampicin*. Virucidal topical drugs - *oksoline*, *tebrofen*, *butaminofen* (Belarus), *bonafton*.

3.10.7. Antiprotozoal drugs

Antimalarials: artesunate, artemether, chloroquine, mefloquine, quinine, pyrimethamine, primaquine. Antiamoebic drugs: metronidazole, tinidazole, doxycycline, emetine, chloroquine. Drugs, used for treat trichomoniasis: tinidazole, metronidazole, trihomonotid. Drugs, used for giardiasis: metronidazole, tinidazole, mepakrin, furazolidone. Drugs, used for toxoplasmosis: pyrimethamine in combination with sulfonamides (sulfadiazine, sulfadimidine) and antibiotics (clindamycin, azithromycin). Drugs, used for leishmaniasis: sodium stibogluconate, pentamidine, mepakrin. Drugs, used for pneumocystosis: Co-trimoxazole, pentamidine isetionat, atovaquone.

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

3.10.8. Antihelminthic drugs

Antiparasitic (anthelmintics) mebendazole, pyrantel, albendazole, piperazine adipate, levamisole, praziquantel, niclosamide.

Mechanisms of action. Principal of applications. Adverse effects. Drugs, used for intestinal nematodes, and cestodiasis antitremitode. Properties, application features, side effects. General characteristics of the drugs used in extra-intestinal helminths.

3.10.9. Antiseptics and disinfectants

The concept of antiseptics and disinfection. History of the use of antiseptics (A.P. Nelyubin, D.Lister, I.Zemmelveys). The difference of antiseptics and disinfectants from chemotherapeutic agents. Requirements for antiseptics. Conditions determining the antimicrobial activity of antiseptics. Basic mechanisms of their action on pathogens. Classification antiseptic chemical structure: detergents (*N - cetylpyridinium chloride*, *tserigel*); metal compounds (*mercury dichloride*, *mercury oxide yellow*, *silver nitrate*, *zinc oxide*, *copper sulfate*); halogen compounds (*chloramine B*, *povidone-iodine*, *alcohol solution of iodine*, *potassium iodide*, *Lugol's solution*); acids and alkalis (*boric acid*, *ammonia water*); antiseptics aromatic (*phenol clean*, *birch tar*, *resorcinol*); antiseptics aliphatic (*ethyl alcohol*, *formaldehyde solution*); oxidizing agents (*potassium permanganate*, *hydrogen peroxide*); nitrofurans derivatives (*furatsilin*); dyes (*methylene blue*, *brilliant green*, *etacridine lactate*); biguanides (*chlorhexidine*). Antiplaque drugs (*triclosan*, *chlorhexidine*, *aminofluorides*). The mechanism of action, use in medicine.

3.10.10. Anticancer agents.

Principles of cancer chemotherapy, the mechanisms of action of anti-cancer drugs. Features antitumor effect of alkylating agents, antimetabolites, platinum drugs, antibiotics, hormonal agents and antagonists of hormones, enzymes. Complications of chemotherapy of tumors, their prevention.

3.10.11. Final lesson on «Chemotherapeutic drugs»

3.11. Drug-to-drug interaction

Co-administration of drugs (poly-drug therapy or combination therapy). Indications for combination therapy. Possible results of drug interaction: synergy, antagonism, their types. Pharmaceutical and pharmacological interaction. Variety of pharmacological interaction (pharmacokinetic, pharmacodynamic).

3.12. Various pharmaceutical products (biologically active supplements, phytopreparations, etc.)

Biologically active supplements, their classification. Physiological and pharmacological effects on the basic regulatory and metabolic processes of man. The role and importance of phytotherapy in medicine. Features of the use of medicinal plants and complex preparations from them in clinical practice. Efficacy and safety of phytopreparations.

3.13. Homeopathic remedies

The history of the discovery and application of the homeopathic method of treatment. Basic principles of homeopathy treatment. The difference between homeopathy and pharmacotherapy. The concept of a dose in homeopathy. Homeopathic dilutions. Methods of preparation of homeopathic remedies.

3.14. Principles of the treatment of acute drug poisoning. Emergency aid drugs

Medicines and poisons. Definition. Classification of pharmaceutical substances in their toxicity, hazard (List A, List B). Toxicokinetics, toxicodynamics. Basic mechanisms of toxic action. Basic principles of pharmacological treatment of poisoning substances. First aid. Assistance measures, depending on the routes of poison in the body.

The main groups of antidotal drugs. Toxicotropic antidotes (binding, neutralizing, warning absorption and help remove toxic substances from the body): a) acting on the physico-chemical principle - *activated charcoal, alginic acid*; b) acting on the chemical principle - *unitiol, mekaptid, dexrazoxane, calcium trisodium pentetate, penicillamine, pentatsin*. Toxicokinetic antidotes (accelerating biotransformation poison toxic metabolites) - *trimedoxime bromide, methylthioninium chloride (methylene blue), sodium thiosulfate, ethyl alcohol, antioxidants*. Pharmacological (functional) antagonists - *atropine, naloxone, esmolol, flumazenil, acetylcysteine*, etc. Immunological antidote - specific antitoxic serum (*monovalent anti-digoxine, anti-botulinic, anti-caracurt, anti-snake serum*). The mechanism of action of antidotal drugs. Conditions for their use. Prevention of acute drug poisoning.

EDUCATIONAL-METHODICAL MAP OF DISCIPLINE

Class №	Code and section title, theme, list of studied questions	Hours in class		Self-studies	Equipment	Form of control
		lectures	practical classes			
1	2	3	4	5	7	8
5 semester						
1.	Introduction. General prescription	-	-	8		
1.1.	Subject of pharmacology. Terminology. Sources and stages of creating medicines. Legislation in the field of medicines	-	-	2		Interviews, control questions, control work
1.2.	Rules for the formulation of prescriptions for the prescription of drugs in various dosage forms	-	9	6	40	Interviews, control questions, control work
2.	General pharmacology	6	12	11		
2.1.	Pharmacokinetics of drugs	4	6	5		
2.1.1.	Fundamentals of pharmacokinetics. Principles of dosing of drugs	2	3	3	1;2	Interviews, tests, control questions, control work, referates, electronic tests
2.1.2.	Biotransformation and excretion of drugs. Correction of the dosage regimen of drugs with a change in clearance and volume of distribution	2	3	2	3;4	Interviews, tests, control questions, control work, referates, electronic tests

2.2.	Pharmacodynamics of drugs	2	3	2		Interviews, tests, control questions, control work, referates, electronic tests
2.3.	Final lesson on «General prescription. General pharmacology»	-	3	4	5;6	Electronic tests, control work
3.	Special pharmacology					
3.1.	Drugs affecting peripheral nervous system	4	15	10		
3.1.1.	Cholinergic drugs	2	6	3	7;8;9	Interviews, tests, control questions, control work, referates, electronic tests
3.1.2.	Adrenergic drugs	2	6	3	7;10;11;12	Interview/s, tests, control questions, control work, referates, electronic tests
3.1.3.	Drugs affecting afferent nerves endings. Final lesson on «Drugs affecting peripheral nervous system»	-	3	4	42	Interviews, tests, control questions, control work, referates, electronic tests
3.2.	Drugs affecting the central nervous system (laboratory classes and lectures in 5 semester)	8	18	9		
3.2.1.	General anesthetics: Ethyl alcohol	2	3	1	42	Interviews, tests, control questions, control work, referates, electronic tests

3.2.2.	Analgic drugs		3	2	24;25;26	Interviews, tesis, control questions, control work, referates, electronic tests
3.2.3.	Anticonvulsants				22	Interviews, tests, control questions, control work, referates, electronic tests
3.2.4.	Antiparkinsonian drugs	2	3	1	23	Interviews, tests, control questions, control work, referates, electronic tests
3.2.5.	Anxiolytic and sedative-hypnogenic drugs		3	2	21,42	Interviews, tests, control questions, control work, referates, electronic tests
3.2.6.	Antipsychotic drugs	2	3	1	21,42	Interviews, tests, control questions, control work, referates, electronic tests
3.2.7. 3.2.8.	Antidepressants, normothymic drugs. Psychostimulants, nootropic drugs. Credit	2	3	2	21,42	Interviews, tests, control questions, control work, referates, electronic tests

3.3.	Drugs affecting the functions of effector organs and systems (lectures in 5 semester)	4	-	-	-	-		
3.3.1.	Diuretic drugs (lecture)	2	-	-	-	-		
3.3.2.	Drugs affecting cardio-vascular system (lectures in 5 semester)	2	-	-	-	-		
3.3.2.1.	Anti-hypertensive drugs (lecture)	2	-	-	-	-		
	6 semester							
3.2.9.	Final lesson on «Drugs affecting central nervous system»	-	3	3	3	21,42		Electronic tests, control work
3.3.	Drugs affecting the functions of effector organs and systems (laboratory classes and lectures in 6 semester)	10	30		19			
	Diuretic drugs (laboratory class)		3				13	Interviews, tests, control questions, control work, reiterates, electronic tests
3.3.1.		-			1			
3.3.2.	Drugs affecting cardio-vascular system (laboratory classes and lectures in 6 semester)	6	12				13;14;15;17;18;19	Interviews, tests, control questions, control work, reiterates, electronic tests
	Anti-hypertensive drugs		3		2			Interviews, tests, control questions, control work, reiterates, electronic tests
3.3.2.1.		-					13;14;15;17;18;19	Interviews, tests, control questions, control work, reiterates, electronic tests
3.3.2.2.	Antianginal and other antiischemic drugs. Hypolipidemic drugs	2	3		2		13;14;15;17;18;19	Interviews, tests, control questions, control work, reiterates, electronic tests

3.3.2.3.	Drugs used for the treatment of heart failure	2	3	2	13;14;15;17; 18;19	Interviews, tests, control questions, control work, referates, electronic tests
3.3.2.4.	Antiarrhythmic drugs	2	3	2	13;14;15;17; 18;19	Interviews, tests, control questions, control work, referates, electronic tests
3.3.3.	Final lesson on «Drugs affecting the cardiovascular system and kidney renal function» Drugs affecting blood system	-	3	4	13;14;15;17; 18;19	Electronic tests, control work
3.3.4.	Drugs affecting the gastrointestinal tract	2	3	2	20,42	Interviews, tests, control questions, control work, referates, electronic tests
3.3.5.	Drugs affecting the respiratory system	2	6	2	31,32	Interviews, tests, control questions, control work, referates, electronic tests
3.3.6.	Drugs affecting the respiratory system	-	3	2	29,30,42	Interviews, tests, control questions, control work, referates, electronic tests
3.4.	Vitamin drugs	-	3	2	42	Interviews, tests, control questions, control work, referates, electronic tests
3.5.	Hormons	4	15	10		
3.5.1.	Hypothalamic and pituitary hormones	2	3	2	42	Interviews, tests, control questions, control work, referates, electronic tests

3.5.2.	Thyroid and antithyroid hormone drugs		3	2	34	Interviews, tests, control questions, control work, referates, electronic tests
3.5.3.	Regulators of calcium homeostasis		3	2	42	Interviews, tests, control questions, control work, referates, electronic tests
3.5.4.	Pancreatic hormones and antidiabetic drugs	2	3	2	42	Interviews, tests, control questions, control work, referates, electronic tests
3.5.5.	Adrenocortical hormone drugs		3	2	42	Interviews, tests, control questions, control work, referates, electronic tests
3.5.6.	Sex hormones, their analogues and antagonists		3	2	33	Interviews, tests, control questions, control work, referates, electronic tests
3.6.	Credit	-	3	2	42	Interviews, tests, control questions, control work, referates, electronic tests
3.7.	Anti-inflammatory drugs (<i>lecture</i>)	2	-	-		
3.8.	Anti-gout drugs (<i>lecture</i>)	2	-	-		
	7 semester					
3.7. 3.8.	Anti-inflammatory drugs, Anti-gout drugs (<i>laboratory class</i>)	-	3	5	27,28	Interviews, tests, control questions, control work, referates, electronic tests
3.9.	Immunomodulating drugs	4	6	5	29,30	Interviews, tests, control questions, control work, referates, electronic tests
3.10.	Chemotherapeutic drugs	20	33	70		
3.10.1.	Bacterial cellular wall synthesis inhibitors	2	3	5	35,42	Interviews, tests, control questions, control work, referates, electronic tests
3.10.2.	Inhibitors of microbial protein synthesis	2	3	5	35,42	Interviews, tests, control questions, control work, referates, electronic tests

3.10.3.	Inhibitors of RNA synthesis	2	3	5	35,42	Interviews, tests, control questions, control work, referates, electronic tests
3.10.4.	Antimycobacterial drugs	2	3	10	42	Interviews, tests, control questions, control work, referates, electronic tests
3.10.5.	Antifungal drugs	2	3	10	42	Interviews, tests, control questions, control work, referates, electronic tests
3.10.6.	Antiviral drugs	2	3	10	36,42	Interviews, tests, control questions, control work, referates, electronic tests
3.10.7.	Antiprotozoal drugs	2	3	5	37,42	Interviews, tests, control questions, control work, referates, electronic tests
3.10.8.	Anthelmintic drugs	2	3	2	42	Interviews, tests, control questions, control work, referates, electronic tests
3.10.9.	Antiseptics and disinfectants	2	3	4	42	Interviews, tests, control questions, control work, referates
3.10.10	Anticancer drugs	2	3	4	42	Interviews, tests, control questions, control work, referates, electronic tests
3.10.11	Final lesson on «Chemotherapeutic drugs»	-	3	10		Electronic tests, control work
3.11.	Drug-to-drug interaction	2	3	5	41,42	Interviews, tests, control questions
3.12.	Various pharmaceutical products (biologically active supplements, phytopreparations, etc.)	2	-	5		Control questions
3.13.	Homeopathic remedies	2	-	5		Control questions
3.14.	Principles of the treatment of acute drug poisoning. Emergency aid drugs	2	3	5	42	Interviews, tests, control questions, control work, referates
	Total hours	72	156	174		

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: workbook. Part 1 / R. N. Alyautdin. ; ed.by V. P. Fisenko; engl. ed. by I.Yu. Markovina. Moscow : Geotar-Media, 2010. 256 p.

Additional

3. Katzung, B.G. Basic and Clinical Pharmacology / B.G. Katzung, A.J.. Trevor. 14th ed. New York: McGraw-Hill Medical, 2017. 1264 p.

4. Trevor A.G. Katzung & Trevor's Pharmacology Examination and Board Review / A.G. Trevor, B.G. Katzung, M. Knuidering-Hall. 11th ed. New York: McGraw-Hill Medical, 2015. 592 p.

5. Brunton L.L. Goodman & Gilman's The Pharmacological basis of Therapeutics / L.L. Brunton, B. Knollman, R. Hilal-Dandan. – 13th ed. – McGraw-Hill, 2017. 1440 p.

6. Brenner, G. M. Pharmacology / G. M. Brenner, C. M. Stevens. 3rd ed. Philadelphia : Saunders Elsevier, 2010.

7. Rang and Dale's Pharmacology. / H. P. Rang [et al.]. 7th ed. Edinburgh : Elsevier, Churchill Livingstone, 2012. 777 p.

8. Craig, C. R. Modern Pharmacology with Clinical Applications / C. R. Craig, R. E. Stitzel. 6th ed. Lippincott Williams & Wilkins. 832 p.

9. AHFS Drug Information. – Bethesda, MD : American Society of Health-System Pharmacists, 2012.

10. Briggs, G. G. Drugs in Pregnancy & Lactation : A Reference Guide to Fetal and Neonatal Risk / G. G. Briggs, R. K. Freeman, S. J. Yaffe 6th ed. Philadelphia : Lippincott Williams & Wilkins, 2011. 1595 p.

11. Physicians' Desk Reference. 65th ed. Montvale, NJ : Thomson PDR, 2011.

12. Baxter, K. Stockley's drug interactions : a source book of interactions, their mechanisms, clinical importance, and management. 9th ed. London : Pharmaceutical Press, 2010. 1792 p.

LIST OF TRAINING ILLUSTRATIONS

(Illustrative material - tables, pictures, slides)

1. Absorption.
2. Distribution.
3. Excretion and elimination.
4. Stationary concentration (Css).
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 AVAILABLE DIAGNOSTIC TOOLS

For the diagnosis of competences, use following forms:

1. Verbal form.
2. The written form.
3. Verbal-writing.
4. Technical shape.

For verbal diagnostic competencies include:

1. Interviews.

By writing diagnostic competencies include:

1. Tests.
2. Control questions.
3. Examinations.
4. Referates.

By verbal- writing diagnostic competencies include:

1. Credits.
2. Examinations.

For technical form of diagnostic competencies include:

1. Electronic tests.

LIST OF PRACTICAL SKILLS

1. The skill of assigning a drug to a certain pharmacological group.
2. The skills of substituting drugs that are absent in the pharmacy for their analogs, taking into account the dosage form and contraindications to their purpose.

LIST OF LECTURES

5 semester

1. Fundamentals of pharmacokinetics. Principles of dosing of drugs.
2. Biotransformation and excretion of drugs. Correction of the dosage regimen of drugs with a change in clearance and volume of distribution.
3. Pharmacodynamics of drugs.
4. Cholinergic drugs.
5. Adrenergic drugs.
6. General anesthetics. Ethyl alcohol. Analgetic drugs.
7. Anticonvulsants. Antiparkinsonian drugs.
8. Anxiolytic and sedative-hypnogenic drugs. Antipsychotic drugs.
9. Antidepressants, normothymic drugs. Psychostimulants, nootropic drugs.
10. Diuretic drugs.
11. Antihypertensive drugs.

6 semester

1. Antianginal and other antiischemic drugs. Hypolipidemic drugs.
2. Drugs used for the treatment of heart failure.
3. Antiarrhythmic drugs.
4. Drugs affecting blood system.
5. Drugs affecting the gastrointestinal tract.
6. Hypothalamic and pituitary hormones. Thyroid and antithyroid hormone drugs. Regulators of calcium homeostasis. Pancreatic hormones and antidiabetic drugs
7. Adrenocortical hormone drugs. Sex hormones, their analogues and antagonists.

8. Anti-inflammatory drugs.
9. Anti-gout drugs.

7 semester

1. Immunomodulating drugs, part 1.
2. Immunomodulating drugs, part 2.
3. Bacterial cellular wall synthesis inhibitors.
4. Inhibitors of microbial protein synthesis.
5. Inhibitors of RNA synthesis.
6. Antimycobacterial drugs.
7. Antifungal drugs.
8. Antiviral drugs.
9. Antiprotozoal drugs.
10. Anthelmintic drugs.
11. Antiseptics and disinfectants.
12. Anticancer drugs.
13. Drug-to-drug interaction.
14. Various pharmaceutical products (biologically active supplements, phytopreparations, etc.).
15. Homeopathic remedies.
16. Principles of the treatment of acute drug poisoning. Emergency aid drugs.

LIST OF LABORATORY (*PRACTICAL*) STUDIES

5 semester

1. Rules for the formulation of prescriptions for the prescription of drugs in various dosage forms. Solid drug forms.
2. Prescribing of liquid drug forms.
3. Prescribing of soft and injectable drug forms.
4. Pharmacokinetics of drugs. Fundamentals of pharmacokinetics. Principles of dosing of drugs.
5. Biotransformation and excretion of drugs. Correction of the dosage regimen of drugs with a change in clearance and volume of distribution.
6. Pharmacodynamics of drugs.
7. Final lesson on «General prescription. General pharmacology».
8. Cholinomimetic and anticholinesterase drugs.
9. Anticholinergic drugs.
10. Adrenergic drugs.
11. Antiadrenergic drugs.
12. Drugs affecting afferent nerves endings. Final lesson on «Drugs affecting peripheral nervous system».
13. General anesthetics. Ethyl alcohol.
14. Analgetic drugs.
15. Anticonvulsants. Antiparkinsonian drugs.
16. Anxiolytic and sedative-hypnogenic drugs.
17. Antipsychotic drugs.

18. Antidepressants, normothymic drugs. Psychostimulants, nootropic drugs. Credit.

6 semester

1. Final lesson on «Drugs affecting central nervous system».
2. Diuretic drugs.
3. Antihypertensive drugs.
4. Antianginal and other antiischemic drugs. Hypolipidemic drugs.
5. Drugs used for the treatment of heart failure.
6. Antiarrhythmic drugs.
7. Final lesson on «Drugs affecting the cardiovascular system and kidney renal function».
8. Drugs affecting blood system.
9. Drugs affecting the gastrointestinal tract, part 1.
10. Drugs affecting the gastrointestinal tract, part 2.
11. Drugs affecting the respiratory system.
12. Vitamin drugs.
13. Hypothalamic and pituitary hormones.
14. Thyroid and antithyroid hormone drugs.
15. Regulators of calcium homeostasis.
16. Pancreatic hormones and antidiabetic drugs.
17. Adrenocortical hormone drugs. Sex hormones, their analogues and antagonists.
18. Credit.

7 semester

1. Anti-inflammatory drugs. Anti-gout drugs.
2. Immunomodulating drugs, part 1.
3. Immunomodulating drugs, part 2.
4. Bacterial cellular wall synthesis inhibitors.
5. Inhibitors of microbial protein synthesis.
6. Inhibitors of RNA synthesis.
7. Antimycobacterial drugs.
8. Antifungal drugs.
9. Antiviral drugs.
10. Antiprotozoal drugs.
11. Anthelmintic drugs.
12. Antiseptics and disinfectants.
13. Anticancer drugs.
14. Final lesson on «Chemotherapeutic drugs».
15. Drug-to-drug interaction.
16. Principles of the treatment of acute drug poisoning. Emergency aid drugs.

**PROTOCOL OF AGREEMENT OF THE CURRICULUM IN PHARMACOLOGY
WITH OTHER DISCIPLINES**

Dicipline	Department	Suggestions for redistribution of curriculum content (for working)	Decided (with the date and protocol number)
1. Normal Physiology	Department of Normal Physiology	Proposals for the amendment of the content of the curriculum -	Approved. Protocol № 9a 15.05.2018
2. Pathological Physiology	Department of Pathological Physiology	Proposals for the amendment of the content of the curriculum -	Approved. Protocol № 9a 15.05.2018
3. Biological Chemistry	Department of Biological Chemistry	Proposals for the amendment of the content of the curriculum -	Approved. Protocol № 9a 15.05.2018
4. Microbiology, Virology, Immunology	Department of Microbiology, Virology, Immunology	Proposals for the amendment of the content of the curriculum -	Approved. Protocol № 9a 15.05.2018
5. Latin	Department of Latin language	Proposals for the amendment of the content of the curriculum -	Approved. Protocol № 9a 15.05.2018

Authors:

Head of the Department of
Pharmacology of Belarusian State
Medical University



N.A. Bizunok

Professor of the Department of
Pharmacology of Belarusian State
Medical University



B.V. Dubovik

Associate Professor of the Department
of Pharmacology of Belarusian State
Medical University



B.A. Valynets

Associate Professor of the Department
of Pharmacology of Belarusian State
Medical University



A.U. Vauchok

The content, design and the accompanying documents conform to specified requirements.

Dean of the Dental Faculty

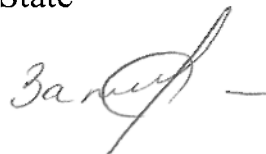
12.06 2018



S.N. Parchamovich

Expert-methodologist of Belarusian State
Medical University

12.06 2018



S.V. Zaturanova

Head of the Department
of Foreign Languages,
Associate Professor



M.N. Petrova

СВЕДЕНИЯ ОБ АВТОРАХ УЧЕБНОЙ ПРОГРАММЫ:

Фамилия, имя, отчество **БИЗУНОК НАТАЛЬЯ АНАТОЛЬЕВНА**
Должность, ученая Заведующий кафедрой фармакологии, доктор
степень, ученое звание медицинских наук, профессор
☎ служебный 207-94-92
Факс: 017) 277-12-02
E-mail: Bizunokna@bsmu.by

Фамилия, имя, отчество **ДУБОВИК БОРИС ВАЛЕНТИНОВИЧ**
Должность, ученая Профессор кафедры фармакологии, доктор
степень, ученое звание медицинских наук, профессор
☎ телефон служебный 277-12-69
☎ телефон моб. 8029- 169-16-80
Факс: —
e-mail: —

Фамилия, имя, отчество **ВОЛЫНЕЦ БОРИС АЛЕКСАНДРОВИЧ**
Должность, ученая Доцент кафедры фармакологии, кандидат
степень, ученое звание медицинских наук, доцент
☎ служебный 277-12-17
Факс: 017) 277-12-02
E-mail:

Фамилия, имя, отчество **ВОЛЧЕК АЛЕКСАНДР ВЛАДИМИРОВИЧ**
Должность, ученая Доцент кафедры фармакологии, кандидат
степень, ученое звание медицинских наук
☎ служебный 277-12-17
Факс: 017) 277-12-02
E-mail: