

Документ подписан простой электронной подписью
Информация о владельце:
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Должность: Ректор
Дата подписания: 26.05.2026 15:00:45
Уникальный программный ключ:
ca953a0120d891083f939673078ef1a989dae18a

**Federal State Autonomous Educational Institution for Higher Education
Peoples' Friendship University of Russia named after Patrice Lumumba (RUDN)**

Medical Institute

educational division (faculty/institute/academy) as higher education programme developer

COURSE SYLLABUS

PHARMACOLOGY

Recommended by the Didactic Council for the Education Field of:

31.05.01 General Medicine
(Field of studies / specialty code and title)

**The course instruction is implemented within the professional education
programme of higher education:**

General Medicine
(higher education programme profile/specialization title)

1. COURSE GOAL(s)

The discipline "Pharmacology" is included in the program of the specialty "General Medicine" in the direction 31.05.01 "General Medicine" and is studied in semesters 5 and 6 of the 3rd year. The discipline is implemented by the Department of General and Clinical Pharmacology. The discipline consists of 7 sections and 30 topics and is aimed at studying the general patterns of the influence of drugs on the human body, the parameters of the pharmacokinetics of drugs, mechanisms of action, pharmacodynamic effects and their dependence on the physicochemical properties of the active substance, the basic principles of effective and safe pharmacotherapy.

The goal of the course «Pharmacology» is to form in students a system of knowledge about the principles of classification of drugs, their mechanisms of action, pharmacological effects, indications and contraindications for use; principles of combining drugs, the risk of developing adverse drug reactions and their prophylaxis, the rules for writing prescriptions for drugs and drugs rational use.

2. REQUIREMENTS FOR LEARNING OUTCOMES

The mastering of the discipline "Pharmacology" is aimed at the development of the following competences /competences in part: GPC-3, GPC-4, GPC-5, GPC-7, PC-3.

Table 2.1. List of competences that students acquire through the course study

Competence code	Competence descriptor	Competence formation indicators (within this course)
GPC-3	Being able to counter doping in sports and fight against it	GPC-3.2. Being able to analyse biochemical, physical and chemical, and molecular and biological mechanisms of the development of pathological processes in the cells of the athlete's body tissues when taking prohibited drugs; defining the principles of the biochemical processes when taking illegal drugs
GPC-4	Being able to use medical devices provided for by the procedure for medical care, and conduct patient examinations in order to determine a diagnosis	GPC-4.1. Being able to use medical devices in accordance with the current procedures for the provision of medical care, clinical guidelines (treatment protocols) on the provision of medical care, care taking into account the medical care standards.
		GPC-4.2. Being able to assess the effectiveness and safety of medical devices.
GPC-5	Being able to assess morpho-functional, physiological conditions and pathological processes in the human body to solve professional tasks	GPC-5.2. Being able to evaluate the results of clinical, laboratory and functional diagnosis when dealing with professional tasks.
GPC-7	Being able to prescribe treatment and monitor its efficacy and safety	GPC-7.1. Mastering skills in the methods of general clinical examination, interpretation

		of laboratory results, instrumental diagnostic methods.
PC-3.	Being able to prescribe treatment and monitor its efficacy and safety	PC-3.1. Being able to develop a treatment plan for a disease or condition taking into account the diagnosis, age and clinical picture in accordance with the current procedures for the provision of medical care, clinical guidelines (treatment protocols) on the provision of medical care taking into account the standards of medical care.
		PC-3.2. Being able to prescribe medicinal drugs, medical devices and medical nutrition taking into account the diagnosis, age and clinical picture of the disease and in accordance with the current procedures for the provision of medical care, clinical guidelines (treatment protocols) on the provision of medical care taking into account the standards of medical care.
		PC-3.4. Being able to assess the efficacy and safety of the use of drugs, medical devices, medical nutrition and other treatment methods
		PC-3.6. Being able to organize personalized treatment for a patient, including pregnant women, elderly and senile patients; assess the efficacy and safety of treatment.

3.COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The course refers to the core/variable/elective* component of (B1) block of the higher educational programme curriculum.

* - Underline whatever applicable.

Within the higher education programme students also master other (modules) and / or internships that contribute to the achievement of the expected learning outcomes as results of the course study.

Table 3.1. The list of the higher education programme components/disciplines that contribute to the achievement of the expected learning outcomes as the course study results

Competence code	Competence descriptor	Previous courses/modules*	Subsequent courses/modules*
GPC-10	Able to solve standard tasks of professional activity	Mathematics Medical informatics Biochemistry	General surgery Radiology Anesthesiology,

Competence code	Competence descriptor	Previous courses/modules*	Subsequent courses/modules*
	using information, bibliographic resources, biomedical terminology, information and communication technologies, taking into account the basic requirements of information security	Biostatistics	Resuscitation, Intensive Care Medical Rehabilitation Professional Diseases Telemedicine Medical Enzymology Modern Methods of Medical Statistics
GPC-6	Able to prepare and apply scientific, research and production, design, organizational, managerial and regulatory documentation in the healthcare system	-	Public Health and Healthcare, Healthcare Economics Hygiene Medical Enzymology

* To be filled in according to the competence matrix of the higher education programme.

4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

The total workload of the course “Pharmacology” is 7 credits (252 academic hours).

Table 4.1. Types of academic activities during the periods of higher education programme mastering (**full-time training**)*

Type of academic activities		Total academic hours	Semesters/training modules	
			5	6
<i>Contact academic hours</i>		158	90	68
including:				
Lectures (LC)		35	18	17
Lab work (LW)		123	72	51
Seminars (workshops/tutorials) (S)		-	-	-
<i>Self-studies</i>		58	36	22
<i>Evaluation and assessment (exam/passing/failing grade)</i>		36	18	18
Course workload	academic hours	252	144	108
	credits	7	4	3

* To be filled in regarding the higher education programme correspondence training mode.

5. COURSE CONTENTS

Table 5.1. Course contents and academic activities types

Course module title	Course module contents (topics)	Academic activities types
Module 1. General Pharmacology	1. Recipe. Introduction to Pharmacology. Types of prescriptions. Formulation rules in the Russian Federation. Types of dosage forms. ATC classification.	LW
	2. Basic principles of pharmacodynamics Mechanisms of drug action. Antagonists, agonists, partial agonists. Target molecules of drugs (receptors, enzymes, ion channels). Types of pharmacological response: expected pharmacological response, hyperreactivity, tachyphylaxis, idiosyncrasy. The relationship between pharmacokinetics and pharmacodynamics. The concept of a therapeutic index, a therapeutic range. Therapeutic drug monitoring (indications, significance, interpretation of results). Pharmacodynamic interaction of drugs.	LC, LW
	3. Basic principles of pharmacokinetics. Basic pharmacokinetic parameters and their significance. Drug bioavailability, drug absorption pathways, drug distribution volume, degree of binding to blood plasma proteins, drug metabolism, drug elimination, half-life, drug excretion routes, clearance. Factors affecting the value of pharmacokinetic parameters. Pharmacokinetic curve. Pharmacokinetic interaction of drugs.	LC, LW
Module 2. Pharmacology of drugs groups. Drugs affecting afferent and efferent innervation	1. Drugs affecting afferent innervation. Local anesthetics. Classification. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.	LC, LW
	2. Cholinergic agents. Anticholinergics. Cholinomimetics. Classification. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.	LC, LW
	3. Adrenomimetics and sympathomimetics Classification. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.	LC, LW

	4. Adrenolythics and sympatholytics. Classification. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.	LC, LW
Module 3. Pharmacology of drugs groups. Drugs affecting the cardiovascular system	1. Diuretics Carbonic anhydrase inhibitors (acetazolamide). Osmodiuretics (mannitol). Loop diuretics (bumetamide, furosemide, ethacrynic acid, torasemide). Diuretics acting on the cortical segment of Henle's loop (hydrochlorothiazide, clopamide, chlorthalidone, metolazone, indapamide). Potassium-sparing diuretics (spironolactone, eplerenone, amiloride, triamterene). Classification. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.	LC, LW
	2. Lipid-lowering agents Statins (fluvastatin, simvastatin, pravastatin, atorvastatin, rosuvastatin); fibrates (clofibrate, bezafibrate, gemfibrozil); derivatives of nicotinic acid (niacin, enduracin); bile acid sequestrants (cholestyramine, colestipol, colesevelam); an inhibitor of intestinal cholesterol absorption (ezetimibe); PCSK9 inhibitors. Classification. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.	LC, LW
	3. Antihypertensive agents Ways to affect the renin-angiotensin system (RAS): pharmacology of ACE inhibitors and angiotensin receptor blockers. Tactics of prescribing ACE inhibitors and angiotensin receptor blockers in hypertension and CHF. Dihydropyridine calcium antagonists: pharmacology and place in the treatment of angina pectoris and hypertension. Centrally acting drugs: alpha2-adrenergic agonists (methyldopa, guanfacine, clonidine) and agonists of I1 - imidazoline receptors. Nitrates (nitroglycerin, isosorbide dinitrate, isosorbide-5-mononitrate, molsidomine): pharmacology, place in the treatment of coronary artery disease. The main challenges of nitrate therapy (tolerance).	LC, LW
	4. Antianginal drugs 1) reducing myocardial oxygen demand (b-blockers); 2) increasing the delivery of oxygen to the heart (coronary dilators of the myotropic antispasmodic and adenosine type of action);	LC, LW

	<p>3) reducing myocardial oxygen demand and increasing oxygen delivery to the heart (nitrates, calcium antagonists).</p> <p>Classification. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.</p>	
	<p>5. Antiarrhythmic drugs.</p> <p>Class I antiarrhythmics (sodium channel blockers). Subclasses Ia (quinidine, novocainamide, disopyramide, aymaline), Ib (lidocaine, mexiletine, trimecaine, diphenin), Ic (etmozine, ethacizin, propafenone, flecainide) - clinical pharmacology, indications, contraindications, side effects. ECG changes while prescribing these drugs.</p> <p>Class II antiarrhythmics: Beta-blockers: nonselective (propranolol, nadolol, sotalol), selective (oxprenolol, metoprolol, atenolol, betaxolol, bisoprolol, nebivolol), drugs with their own sympathomimetic activity (ololkirol-1), drugs with alpha-1-blocking activity (labetalol, carvedilol). Beta-blockers in the treatment of CHF. Clinical pharmacology, indications, contraindications, side effects. ECG changes while prescribing these drugs.</p> <p>Class III antiarrhythmics (potassium channel blockers - amiodarone, sotalol, dofetilide, ibutilide): clinical pharmacology, indications for prescription, ECG changes while prescribing these drugs.</p> <p>Class IV antiarrhythmics (calcium antagonists - verapamil, diltiazem): clinical pharmacology, indications, contraindications, side effects. ECG changes while prescribing these drugs.</p> <p>Additional antiarrhythmic drugs: adenosine, atropine, digoxin.</p>	LC, LW
	<p>6. Drugs to manage heart failure</p> <p>Drugs with a positive inotropic effect: cardiac glycosides, non-glycoside inotropic agents. Classification of inotropic agents. Inhibitors of RAS, gliflozins and other drugs for chronic heart failure. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients. Diagnostics, management, and prevention of adverse reactions. Drug interactions.</p>	LC, LW
Module 4. Pharmacology of drugs groups.	<p>1. Drugs affecting the blood coagulation system.</p> <p>Antiplatelet agents: acetylsalicylic acid, clopidogrel, ticlopidine, abciximab, anagrelide, alprostadil, lysine</p>	LC, LW

<p>Drugs affecting hemostasis and hematopoiesis</p>	<p>acetylsalicylate. Direct anticoagulants: sodium heparin, low molecular weight heparins (sodium enoxaparin, nadroparin, fraxiparin). Indirect anticoagulants: warfarin, coumarins. Fibrinolytics: streptokinase, tissue plasminogen activator (alteplase, prourokinase). Synthetic selective inhibitor of activated factor X (Xa) fondaparinux sodium, rivaroxaban, direct thrombin inhibitor dabigatran. Drugs that increase blood clotting (vitamin K and its analogs, thrombin, hemostatic sponge, fibrinogen). Fibrinolysis inhibitors (aminocaproic acid). Drugs to stop bleeding in patients with hemophilia (factor VIII cryoprecipitate, antihemophilic plasma, coagulation factor VII, coagulation factor IX). Ethamsylate. Classification. Pharmacodynamics of the drug group, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.</p>	
	<p>2. Drugs affecting the hematopoietic system. Iron preparations. Erythropoietin. Preparations containing folic acid, cyanocobalamin. Classification. Pharmacodynamics of the drug group, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.</p>	<p>LC, LW</p>
<p>Module 5. Pharmacology of drugs groups. Drugs affecting the functions of the respiratory system, digestion and metabolic processes</p>	<p>1. Drugs affecting the functions of the respiratory system Beta-2 adreno-agonists: salbutamol, fenoterol, salmeterol, formoterol. M-anticholinergics: ipratropium bromide, tiotropium bromide. Methylxanthines: theophylline, aminophylline. Mast cell membrane stabilizers (cromoglicic acid), antileukotriene drugs (zafirlukast, montelukast, zileuton). Inhalation GCS. Systemic GCS. Antitussive drugs. Mucolytics, mucoregulators, mucokinetics. Antitussive drugs of central action. Classification. Pharmacodynamics of the drug group, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients. The concept of the stepwise therapy for bronchial asthma, therapy of chronic obstructive pulmonary disease. Diagnostics, management, and prevention of adverse reactions. Receptor desensitization syndrome.</p>	<p>LC, LW</p>
	<p>2. Drugs affecting the functions of the digestive system.</p>	<p>LC, LW</p>

	<p>Pharmacology of antacids (sodium bicarbonate, calcium carbonate, aluminum hydroxide, aluminum phosphate, magnesium oxide, magnesium hydroxide).</p> <p>Pharmacology of H₂-histamine receptor blockers (cimetidine, ranitidine, famotidine, nizatidine, roxatidine).</p> <p>Pharmacology of M-anticholinergics: pirenzepine.</p> <p>Pharmacology of proton pump inhibitors (omeprazole, esomeprazole, lansoprazole, pantoprazole, rabeprazole).</p> <p>Prescribing antisecretory agents for the treatment and prevention of gastric ulcer and duodenal ulcer.</p> <p>Pharmacology of prokinetics (metoclopramide, domperidone, trimebutine).</p> <p>Pharmacology of gastrocytoprotectors (bismuth, colloidal bismuth subcitrate, misoprostol, sucralfate).</p> <p>Prescribing antisecretory agents and prokinetics for the treatment and prevention of GERD, functional dyspepsia, NSAID gastropathy.</p> <p>Antibacterial (anti-Helicobacter) drugs in the treatment of peptic ulcer: amoxicillin, clarithromycin, tetracycline, metronidazole. Eradication of H.pylori.</p>	
	<p>3. Hormones of the pituitary gland, hypothalamus, pineal gland, thyroid and pancreas, hypoglycemic drugs. Antidiabetic drugs: insulins (ultrashort, short, intermediate, long acting), sulfonylurea derivatives (glibenclamide), glinides (repaglinide), biguanides (metformin), α-glycosidase inhibitors (acarbose), thiazolidinediones (rosiglitazone), dipeptidyl peptidase inhibitors -4 (DPP-4) (vildagliptin), GLP-1 analogues and agonists (liraglutide), amylin analogues (pramlintide acetate), gliflozins (dapagliflozin).</p> <p>Preparations of thyroid hormones and antithyroid drugs (L-thyroxine, mercazolil, thiamazole, potassium iodide).</p> <p>Preparations of pituitary and hypothalamic hormones.</p> <p>Classification. Pharmacodynamics of the group of drugs, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications. Adverse drug reactions. Drug interactions. Use in special categories of patients. Principles of replacement therapy.</p>	LC, LW
	<p>4. Steroid hormones</p> <p>Sex steroids. Contraceptives. Anabolic steroids. Glucocorticoids.</p> <p>Classification. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.</p>	LC, LW

	<p>5. Drugs affecting immune processes.</p> <p>Cytostatics:</p> <p>Alkylating agents: cyclophosphamide</p> <p>Antimetabolites: azathioprine methotrexate</p> <p>Glucocorticoids: prednisone, etc.</p> <p>Monoclonal antibodies</p> <p>Polyclonal antibodies - anti-thymocyte immunoglobulin</p> <p>4-aminoquinoline derivatives (chloroquine, hydroxychloroquine)</p> <p>D-penicillamine</p> <p>Gold preparations (sodium aurothiomalate, auranofin, etc.).</p> <p>Classification. Pharmacodynamics of the drug group, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications Adverse reactions. Drug interaction. Use in special categories of patients.</p> <p>Immunostimulants.</p> <p>Preparations of bacterial and fungal origin, their synthetic and semi-synthetic analogs.</p> <p>Preparations of animal origin.</p> <p>Cytokines (interferons, interleukins) and stimulators of their formation in the body.</p> <p>Herbal preparations. Classification. Pharmacodynamics of the drug group, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications Adverse reactions. Drug interaction. Use in special categories of patients.</p>	LC, LW
	<p>6. Antiallergic drugs</p> <p>Types of allergic reactions. Pathogenesis of allergic and pseudo-allergic reactions. Points of application of drugs.</p> <p>Drugs for the treatment of immediate-type hypersensitivity reactions:</p> <ol style="list-style-type: none"> 1) agents that prevent the release of histamine and other mediators of allergy - glucocorticoids, cromoglycic acid; 2) antihistamines - H1-histamine blockers; 3) symptomatic agents - adrenergic agonists, myotropic bronchodilators. <p>Drugs for the treatment of delayed-type hypersensitivity reactions: GCS, cytostatics.</p> <p>Classification. Pharmacodynamics of the drug group, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications Adverse reactions. Drug interaction. Use in special categories of patients.</p>	LC, LW
	<p>1. Drugs for anesthesia. Analgesics.</p>	LC, LW

<p>Module 6. Pharmacology of drugs groups. Drugs affecting the central nervous system. Drugs affecting the nociceptive system and the synthesis of pain and inflammation mediators</p>	<p>Preparations for inhalational and intravenous anesthesia. Opioid analgesics. Non-steroidal anti-inflammatory drugs (NSAIDs). Classification. Pharmacodynamics of the group of drugs, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications. Adverse drug reactions. Drug-drug interactions. Use in special categories of patients.</p>	
	<p>2. Sedative drugs. Hypnotic agents. Anxiolytics. Antiepileptic drugs. Classification. Pharmacodynamics of the group of drugs, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications. Adverse drug reactions. Drug-drug interactions. Use in special categories of patients.</p>	LC, LW
	<p>3. Antipsychotics. Antidepressants. Remedies for the treatment of mania. Classification. Pharmacodynamics of the group of drugs, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications. Adverse drug reactions. Drug-drug interactions. Use in special categories of patients.</p>	LC, LW
	<p>4. Psychostimulants. Nootropics. Drugs for neurodegenerative diseases. Classification. Pharmacodynamics of the group of drugs, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications. Adverse drug reactions. Drug-drug interactions. Use in special categories of patients.</p>	LC, LW
<p>Module 7. Pharmacology of drugs groups. Antibacterial, antiviral and antifungal agents</p>	<p>1. Antimicrobial pharmacotherapy. Principles of rational antibiotic therapy. Beta-lactam antibiotics: Beta-lactam antibiotics. Pharmacology of penicillins (benzylpenicillin, amoxicillin, ampicillin, oxacillin, piperacillin). Pharmacology of cephalosporins (1st generation: cefazolin, cephalexin, cefaclor; 2nd generation: cefamandole, cefuroxime; 3rd generation: cefoperazone, cefotaxime, ceftriaxone; 4th generation: cefepime, 5th generation: ceftobiprole). Pharmacology of carbapenems (imipenem, meropenem) and monobactams (aztreonam).</p>	LC, LW
	<p>2. Non-beta-lactam antibiotics and synthetic antimicrobials: Non-beta-lactam antibiotics. Pharmacology of aminoglycosides (gentamicin, amikacin, tobramycin, netilmicin). Pharmacology of macrolides (erythromycin, roxithromycin, azithromycin, clarithromycin).</p>	LC, LW

	<p>Pharmacology of tetracyclines (tetracycline, doxycycline) and glycopeptides (vancomycin, teicoplanin).</p> <p>New groups of antibacterials: oxazolidinediones (linezolid), lipopeptides (daptomycin), glycylcyclines (tigecycline), pleuromutilins (retapamulin).</p> <p>Sulfonamides, quinolone and fluoroquinolone derivatives, 5-nitrofurans, imidazole derivatives.</p> <p>Classification. Pharmacodynamics of the group of drugs, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications. Adverse reactions. Drug interaction. Use in special categories of patients.</p>	
	<p>3. Antiviral, antifungal agents.</p> <p>Antifungals: amphotericin B, itraconazole, ketoconazole, clotrimazole, nystatin, sertaconazole, fluconazole.</p> <p>Antivirals: anti-herpetic, anti-cytomegalovirus, anti-influenza (M2 channel blockers, neuroaminidase inhibitors), antiretroviral drugs.</p>	LC, LW
	<p>4. Anti-tuberculosis drugs.</p> <p>1st line drugs, 2nd line drugs. 3rd line drugs. Tuberculosis chemotherapy regimens.</p> <p>Classification. Pharmacodynamics of the group of drugs, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications. Adverse drug reactions. Drug-drug interactions. Use in special categories of patients.</p>	LC, LW
	<p>5. Antiprotozoal, antisyphilitic, anthelmintic drugs</p> <p>Classification. Pharmacodynamics of the group of drugs, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications. Adverse drug reactions. Drug-drug interactions. Use in special categories of patients.</p>	LC, LW

* - to be filled in only for **full**-time training; *LC* - lectures; *LW* - lab work; *S* - seminars.

5. COURSE CONTENTS

Table 5.1. Course contents and academic activities types

Course module title	Course module contents (topics)	Academic activities types
Module 1. General Pharmacology	1. Recipe. Introduction to Pharmacology. Types of prescriptions. Formulation rules in the Russian Federation. Types of dosage forms. ATC classification.	LW

	<p>2. Basic principles of pharmacodynamics Mechanisms of drug action. Antagonists, agonists, partial agonists. Target molecules of drugs (receptors, enzymes, ion channels). Types of pharmacological response: expected pharmacological response, hyperreactivity, tachyphylaxis, idiosyncrasy. The relationship between pharmacokinetics and pharmacodynamics. The concept of a therapeutic index, a therapeutic range. Therapeutic drug monitoring (indications, significance, interpretation of results). Pharmacodynamic interaction of drugs.</p>	LC, LW
	<p>3. Basic principles of pharmacokinetics. Basic pharmacokinetic parameters and their significance. Drug bioavailability, drug absorption pathways, drug distribution volume, degree of binding to blood plasma proteins, drug metabolism, drug elimination, half-life, drug excretion routes, clearance. Factors affecting the value of pharmacokinetic parameters. Pharmacokinetic curve. Pharmacokinetic interaction of drugs.</p>	LC, LW
Module 2. Pharmacology of drugs groups. Drugs affecting afferent and efferent innervation	<p>1. Drugs affecting afferent innervation. Local anesthetics. Classification. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.</p>	LC, LW
	<p>2. Cholinergic agents. Anticholinergics. Cholinomimetics. Classification. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.</p>	LC, LW
	<p>3. Adrenomimetics and sympathomimetics Classification. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.</p>	LC, LW
	<p>4. Adrenolythics and sympatholytics. Classification. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.</p>	LC, LW
Module 3. Pharmacology of drugs groups. Drugs affecting the	<p>1. Diuretics Carbonic anhydrase inhibitors (acetazolamide). Osmodiuretics (mannitol). Loop diuretics (bumetamide, furosemide, ethacrynic acid, torasemide). Diuretics acting on the cortical segment of Henle's loop</p>	LC, LW

cardiovascular system	(hydrochlorothiazide, clopamide, chlorthalidone, metolazone, indapamide). Potassium-sparing diuretics (spironolactone, eplerenone, amiloride, triamterene). Classification. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.	
	2. Lipid-lowering agents Statins (fluvastatin, simvastatin, pravastatin, atorvastatin, rosuvastatin); fibrates (clofibrate, bezafibrate, gemfibrozil); derivatives of nicotinic acid (niacin, enduracin); bile acid sequestrants (cholestyramine, colestipol, colesevelam); an inhibitor of intestinal cholesterol absorption (ezetimibe); PCSK9 inhibitors. Classification. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.	LC, LW
	3. Antihypertensive agents Ways to affect the renin-angiotensin system (RAS): pharmacology of ACE inhibitors and angiotensin receptor blockers. Tactics of prescribing ACE inhibitors and angiotensin receptor blockers in hypertension and CHF. Dihydropyridine calcium antagonists: pharmacology and place in the treatment of angina pectoris and hypertension. Centrally acting drugs: alpha2-adrenergic agonists (methyldopa, guanfacine, clonidine) and agonists of I1 - imidazoline receptors. Nitrates (nitroglycerin, isosorbide dinitrate, isosorbide-5-mononitrate, molsidomine): pharmacology, place in the treatment of coronary artery disease. The main challenges of nitrate therapy (tolerance).	LC, LW
	4. Antianginal drugs 1) reducing myocardial oxygen demand (b-blockers); 2) increasing the delivery of oxygen to the heart (coronary dilators of the myotropic antispasmodic and adenosine type of action); 3) reducing myocardial oxygen demand and increasing oxygen delivery to the heart (nitrates, calcium antagonists). Classification. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.	LC, LW
	5. Antiarrhythmic drugs. Class I antiarrhythmics (sodium channel blockers). Subclasses Ia (quinidine, novocainamide, disopyramide, aymaline), Ib (lidocaine, mexiletine, trimecaine,	LC, LW

	<p>diphenin), Ic (etmozine, ethacizin, propafenone, flecainide) - clinical pharmacology, indications, contraindications, side effects. ECG changes while prescribing these drugs.</p> <p>Class II antiarrhythmics: Beta-blockers: nonselective (propranolol, nadolol, sotalol), selective (oxprenolol, metoprolol, atenolol, betaxolol, bisoprolol, nebivolol), drugs with their own sympathomimetic activity (oolokiol-1), drugs with alpha-1-blocking activity (labetalol, carvedilol). Beta-blockers in the treatment of CHF. Clinical pharmacology, indications, contraindications, side effects. ECG changes while prescribing these drugs.</p> <p>Class III antiarrhythmics (potassium channel blockers - amiodarone, sotalol, dofetilide, ibutilide): clinical pharmacology, indications for prescription, ECG changes while prescribing these drugs.</p> <p>Class IV antiarrhythmics (calcium antagonists - verapamil, diltiazem): clinical pharmacology, indications, contraindications, side effects. ECG changes while prescribing these drugs.</p> <p>Additional antiarrhythmic drugs: adenosine, atropine, digoxin.</p>	
	<p>6. Drugs to manage heart failure</p> <p>Drugs with a positive inotropic effect: cardiac glycosides, non-glycoside inotropic agents. Classification of inotropic agents. Inhibitors of RAS, gliflozins and other drugs for chronic heart failure. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients. Diagnostics, management, and prevention of adverse reactions. Drug interactions.</p>	LC, LW
<p>Module 4. Pharmacology of drugs groups. Drugs affecting hemostasis and hematopoiesis</p>	<p>3. Drugs affecting the blood coagulation system.</p> <p>Antiplatelet agents: acetylsalicylic acid, clopidogrel, ticlopidine, abciximab, anagrelide, alprostadil, lysine acetylsalicylate. Direct anticoagulants: sodium heparin, low molecular weight heparins (sodium enoxaparin, nadroparin, fraxiparin). Indirect anticoagulants: warfarin, coumarins. Fibrinolytics: streptokinase, tissue plasminogen activator (alteplase, prourokinase). Synthetic selective inhibitor of activated factor X (Xa) fondaparinux sodium, rivaroxaban, direct thrombin inhibitor dabigatran. Drugs that increase blood clotting (vitamin K and its analogs, thrombin, hemostatic sponge, fibrinogen). Fibrinolysis inhibitors (aminocaproic acid). Drugs to stop bleeding in patients</p>	LC, LW

	<p>with hemophilia (factor VIII cryoprecipitate, antihemophilic plasma, coagulation factor VII, coagulation factor IX). Ethamsylate. Classification. Pharmacodynamics of the drug group, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.</p>	
	<p>4. Drugs affecting the hematopoietic system. Iron preparations. Erythropoietin. Preparations containing folic acid, cyanocobalamin. Classification. Pharmacodynamics of the drug group, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.</p>	LC, LW
<p>Module 5. Pharmacology of drugs groups. Drugs affecting the functions of the respiratory system, digestion and metabolic processes</p>	<p>1. Drugs affecting the functions of the respiratory system Beta-2 adreno-agonists: salbutamol, fenoterol, salmeterol, formoterol. M-anticholinergics: ipratropium bromide, tiotropium bromide. Methylxanthines: theophylline, aminophylline. Mast cell membrane stabilizers (cromoglicic acid), antileukotriene drugs (zafirlukast, montelukast, zileuton). Inhalation GCS. Systemic GCS. Antitussive drugs. Mucolytics, mucoregulators, mucokinetics. Antitussive drugs of central action. Classification. Pharmacodynamics of the drug group, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients. The concept of the stepwise therapy for bronchial asthma, therapy of chronic obstructive pulmonary disease. Diagnostics, management, and prevention of adverse reactions. Receptor desensitization syndrome.</p>	LC, LW
	<p>2. Drugs affecting the functions of the digestive system. Pharmacology of antacids (sodium bicarbonate, calcium carbonate, aluminum hydroxide, aluminum phosphate, magnesium oxide, magnesium hydroxide). Pharmacology of H₂-histamine receptor blockers (cimetidine, ranitidine, famotidine, nizatidine, roxatidine). Pharmacology of M-anticholinergics: pirenzepine. Pharmacology of proton pump inhibitors (omeprazole, esomeprazole, lansoprazole, pantoprazole, rabeprazole). Prescribing antisecretory agents for the treatment and prevention of gastric ulcer and duodenal ulcer. Pharmacology of prokinetics (metoclopramide, domperidone, trimebutine).</p>	LC, LW

	<p>Pharmacology of gastrocytoprotectors (bismuth, colloidal bismuth subcitrate, misoprostol, sucralfate). Prescribing antisecretory agents and prokinetics for the treatment and prevention of GERD, functional dyspepsia, NSAID gastropathy. Antibacterial (anti-Helicobacter) drugs in the treatment of peptic ulcer: amoxicillin, clarithromycin, tetracycline, metronidazole. Eradication of H.pylori.</p>	
	<p>3. Hormones of the pituitary gland, hypothalamus, pineal gland, thyroid and pancreas, hypoglycemic drugs. Antidiabetic drugs: insulins (ultrashort, short, intermediate, long acting), sulfonylurea derivatives (glibenclamide), glinides (repaglinide), biguanides (metformin), α-glycosidase inhibitors (acarbose), thiazolidinediones (rosiglitazone), dipeptidyl peptidase inhibitors -4 (DPP-4) (vildagliptin), GLP-1 analogues and agonists (liraglutide), amylin analogues (pramlintide acetate), gliflozins (dapagliflozin). Preparations of thyroid hormones and antithyroid drugs (L-thyroxine, mercazolil, thiamazole, potassium iodide). Preparations of pituitary and hypothalamic hormones. Classification. Pharmacodynamics of the group of drugs, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications. Adverse drug reactions. Drug interactions. Use in special categories of patients. Principles of replacement therapy.</p>	LC, LW
	<p>4. Steroid hormones Sex steroids. Contraceptives. Anabolic steroids. Glucocorticoids. Classification. Pharmacodynamics, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications Adverse reactions. Drug interactions. Use in special categories of patients.</p>	LC, LW
	<p>5. Drugs affecting immune processes. Cytostatics: Alkylating agents: cyclophosphamide Antimetabolites: azathioprine methotrexate Glucocorticoids: prednisone, etc. Monoclonal antibodies Polyclonal antibodies - anti-thymocyte immunoglobulin 4-aminoquinoline derivatives (chloroquine, hydroxychloroquine) D-penicillamine Gold preparations (sodium aurothiomalate, auranofin, etc.).</p>	LC, LW

	<p>Classification. Pharmacodynamics of the drug group, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications Adverse reactions. Drug interaction. Use in special categories of patients.</p> <p>Immunostimulants.</p> <p>Preparations of bacterial and fungal origin, their synthetic and semi-synthetic analogs.</p> <p>Preparations of animal origin.</p> <p>Cytokines (interferons, interleukins) and stimulators of their formation in the body.</p> <p>Herbal preparations. Classification. Pharmacodynamics of the drug group, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications Adverse reactions. Drug interaction. Use in special categories of patients.</p>	
	<p>6. Antiallergic drugs</p> <p>Types of allergic reactions. Pathogenesis of allergic and pseudo-allergic reactions. Points of application of drugs. Drugs for the treatment of immediate-type hypersensitivity reactions:</p> <ol style="list-style-type: none"> 1) agents that prevent the release of histamine and other mediators of allergy - glucocorticoids, cromoglycic acid; 2) antihistamines - H1-histamine blockers; 3) symptomatic agents - adrenergic agonists, myotropic bronchodilators. <p>Drugs for the treatment of delayed-type hypersensitivity reactions: GCS, cytostatics.</p> <p>Classification. Pharmacodynamics of the drug group, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications Adverse reactions. Drug interaction. Use in special categories of patients.</p>	LC, LW
<p>Module 6. Pharmacology of drugs groups. Drugs affecting the central nervous system. Drugs affecting the nociceptive system and the synthesis of pain and inflammation mediators</p>	<p>1. Drugs for anesthesia. Analgesics.</p> <p>Preparations for inhalational and intravenous anesthesia. Opioid analgesics. Non-steroidal anti-inflammatory drugs (NSAIDs).</p> <p>Classification. Pharmacodynamics of the group of drugs, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications. Adverse drug reactions. Drug-drug interactions. Use in special categories of patients.</p>	LC, LW
	<p>2. Sedative drugs. Hypnotic agents. Anxiolytics. Antiepileptic drugs.</p> <p>Classification. Pharmacodynamics of the group of drugs, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications. Adverse</p>	LC, LW

	drug reactions. Drug-drug interactions. Use in special categories of patients.	
	3. Antipsychotics. Antidepressants. Remedies for the treatment of mania. Classification. Pharmacodynamics of the group of drugs, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications. Adverse drug reactions. Drug-drug interactions. Use in special categories of patients.	LC, LW
	4. Psychostimulants. Nootropics. Drugs for neurodegenerative diseases. Classification. Pharmacodynamics of the group of drugs, mechanism of action. Pharmacokinetic parameters. Indications. Contraindications. Adverse drug reactions. Drug-drug interactions. Use in special categories of patients.	LC, LW
Module 7. Pharmacology of drugs groups. Antibacterial, antiviral and antifungal agents	1. Antimicrobial pharmacotherapy. Principles of rational antibiotic therapy. Beta-lactam antibiotics: Beta-lactam antibiotics. Pharmacology of penicillins (benzylpenicillin, amoxicillin, ampicillin, oxacillin, piperacillin). Pharmacology of cephalosporins (1st generation: cefazolin, cephalexin, cefaclor; 2nd generation: cefamandole, cefuroxime; 3rd generation: cefoperazone, cefotaxime, ceftriaxone; 4th generation: cefepime, 5th generation: ceftobiprole). Pharmacology of carbapenems (imipenem, meropenem) and monobactams (aztreonam).	LC, LW
	2. Non-beta-lactam antibiotics and synthetic antimicrobials: Non-beta-lactam antibiotics. Pharmacology of aminoglycosides (gentamicin, amikacin, tobramycin, netilmicin). Pharmacology of macrolides (erythromycin, roxithromycin, azithromycin, clarithromycin). Pharmacology of tetracyclines (tetracycline, doxycycline) and glycopeptides (vancomycin, teicoplanin). New groups of antibacterials: oxazolidinones (linezolid), lipopeptides (daptomycin), glycylcyclines (tigecycline), pleuromutilins (retapamulin). Sulfonamides, quinolone and fluoroquinolone derivatives, 5-nitrofurans, imidazole derivatives. Classification. Pharmacodynamics of the group of drugs, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications. Adverse reactions. Drug interaction. Use in special categories of patients.	LC, LW
	3. Antiviral, antifungal agents.	LC, LW

	Antifungals: amphotericin B, itraconazole, ketoconazole, clotrimazole, nystatin, sertaconazole, fluconazole. Antivirals: anti-herpetic, anti-cytomegalovirus, anti-influenza (M2 channel blockers, neuroaminidase inhibitors), antiretroviral drugs.	
	4. Anti-tuberculosis drugs. 1 st line drugs, 2 nd line drugs. 3 rd line drugs. Tuberculosis chemotherapy regimens. Classification. Pharmacodynamics of the group of drugs, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications. Adverse drug reactions. Drug-drug interactions. Use in special categories of patients.	LC, LW
	5. Antiprotozoal, antisyphilitic, anthelmintic drugs Classification. Pharmacodynamics of the group of drugs, mechanism of action. Pharmacokinetic parameters of the drug group. Indications. Contraindications. Adverse drug reactions. Drug-drug interactions. Use in special categories of patients.	LC, LW

* - to be filled in only for **full**-time training: LC - lectures; LW - lab work; S - seminars.

7. RESOURCES RECOMMENDED FOR COURSE STUDY

Main readings:

1. Katzung's Basic and Clinical Pharmacology / edited by Todd W. Vanderah. - 16th edition. - McGraw Hill, 2024. - 1347 p. : il. - Книга на английском языке. - ISBN 978-265-98057-3 : 9676.04.

Additional reading

1. Clinical Pharmacology / P.N. Bennett, M.J. Brown. - 10th ed. ; Книга на английском языке. - Edinburgh : Churchill Livingstone, 2008. - 694 p. : il. - ISBN 978-0-443-10245-5 : 2048.65.

3. Tutorial Guide to Pharmacokinetics: учебное пособие / С.К. Зырянов, О.И. Бутранова, М.Б. Кубаева. – Москва: РУДН, 2022. – 134 с.: ил. ISBN 978-5-209-10837-5

4. Tutorial Guide to Pharmacodynamics [Текст] = Пособие по фармакологии : Учебное пособие / S.K. Zyryanov, O.I. Butranova. - Книга на английском языке. - М. : PFUR, 2019. - 56 с. : ил.

Internet (based) sources

1. Electronic libraries with access for RUDN students:

-Electronic library network of RUDN – ELN RUDN

<http://lib.rudn.ru/MegaPro/Web>

- ELN «University Library online» <http://www.biblioclub.ru>

- ELN Urait <http://www.biblio-online.ru>

- ELN «Student Advisor» www.studentlibrary.ru

- ELN «Lan» <http://e.lanbook.com/>

2. Databases and search engines:

- electronic fund of legal and regulatory and technical documentation
<http://docs.cntd.ru/>
- search system Yandex <https://www.yandex.ru/>
- search system Google <https://www.google.ru/>
- abstract database SCOPUS <http://www.elsevierscience.ru/products/scopus/>

Learning toolkits for self-studies during the development of the discipline*:

1. A course of lectures on the discipline "Pharmacology".
2. Guidelines for self-study on the discipline "Pharmacology"
3. Online educational course on the Stepik platform: "Pharmacology of Antibacterial Agents" Free access: <https://stepik.org/course/123136/promo>

* - all educational and methodological materials for independent work of students are placed in accordance with the current procedure on the page of the discipline on RUDN LMS TUIS!

8. EVALUATION TOOLKIT AND GRADE SYSTEM FOR ASSESSMENT

Evaluation Toolkit (ET) and a point-rating system (PRS)* for assessment the level of competence formation (part of competencies) based on the results of mastering the discipline "Pharmacology" are presented in the Appendix to this Work Program of the discipline.

* - *ET and PRS are formed on the basis of the requirements of the relevant local regulatory act of the RUDN*

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