

	CD 8.5.1 DISCIPLINE CURRICULUM	Edition:	10
		Date:	10.04.2024
		Page. 1/16	

	CD 8.5.1 DISCIPLINE CURRICULUM	Edition:	10
		Date:	10.04.2024
		Page. 1/16	

FACULTY OF MEDICINE NR. 2

STUDY PROGRAM 0912.1 MEDICINE

CHAIR OF PHARMACOLOGY AND CLINICAL PHARMACOLOGY

APPROVED

at the meeting of the Commission for Quality Assurance and Evaluation of the Curriculum Faculty of Medicine
Minutes No. 6 of 20.05.24

Chairman _PhD, Associate Professor _____

Pădure Andrei 

APPROVED

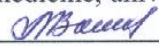
at the Council meeting of the Faculty of Medicine
Minutes No. 9 of 28.05.24

Dean of Faculty of Medicine nr. 2, PhD Associate Professor

Bețiu Mircea 

APPROVED

at the meeting of the chair Pharmacology and clinical pharmacology
Minutes No.21 din 15.04.2024

Head of chair, PhD in medicine, univ. professor
Nicolae Bacinschi 

CURRICULUM

DISCIPLINE PHARMACOLOGY

Integrated studies

Type of course: **Compulsory**

Curriculum developed by the team of authors:

Bacinschi Nicolae, PhD, dr. of med., professor,
Pogonea Ina, dr. of med., associate professor,
Corețchi Ianoș, dr. of med., associate professor,
Catcov Carolina, university assistant
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CD 8.5.1 DISCIPLINE CURRICULUM

Edition: 10

Date: 10.04.2024

Page. 2/16

I. INTRODUCTION

· **General presentation of the discipline: place and role of the discipline in the formation of the specific competences of the professional / specialty training program**

The discipline of pharmacology is an important component of preclinical education seeking knowledge about drugs, and the interactions of drugs and the body.

The content of this subject is intended to form specific competences about drugs, including: prescription of drugs; basic compartments of pharmacology (pharmacokinetics, pharmacogenetics, pharmacodynamics); general laws of interactions of drugs and body; characteristics of drug groups (principles of classification, mechanism of action and pharmacological effects, indications and contra indications, adverse reactions); selection of drugs for different diseases and different pathological states; highlighting of the importance for public health; problems of overdose and intoxication.

● **Mission of the curriculum (aim) in professional training**

The main goal of this subject is to study the fundamental principles of pharmacokinetics and pharmacodynamics of drugs, their interaction with the human organism, formation of knowledge about prescription and correct administration, effective and harmless treatment of multiple diseases and pathological conditions.

Achieving the goal will allow you: the formation of a theoretical basis about drugs; developing a logic way of thinking for the application of the obtained information; highlighting the importance of pharmacology as a medical- biological discipline to achieve a rational, effective and harmless treatment. Knowledge about pharmacology and its continuous perfection is very important since medicine of the 21st century is a more personalized medicine.

● **Languages of the course:** English

● **Beneficiaries:** students of III year, Faculty of Medicine 2

II. MANAGEMENT OF THE DISCIPLINE

Code of discipline		F.05.O.042 / F.06.O.050	
Name of the discipline		Pharmacology	
Responsible person in charge of the discipline		Nicolae Bacinschi, PhD, University Professor	
Year	III	Semesters	V and VI
Total number of hours, including:			240
Lectures	60	Laboratory work	50
Seminars	40	Individual work	90
Form of evaluation	E/E	Number of credits	8

III. TRAINING AIMS WITHIN THE DISCIPLINE OF PHARMACOLOGY

✓ *At the level of knowledge and understanding:*

- **To define** the structure of the prescription and the principles of drugs in different forms;
- **To identify** the concept of raw drug material, substance, form and nomenclature;
- **To identify** drug interactions and incompatibilities;
- **To list** the basic principles of general drug classification;
- **To describe** basic principles of general and special pharmacokinetics, pharmacodynamics, chronopharmacology and pharmacogenetics;
- **To memorize** the groups of drugs, the obligatory preparations with their prescription in different medicinal forms;
- **To list** the classification, mechanism of action, effects, indications, contraindications and side effects of groups of drugs and specific drugs;



CD 8.5.1 DISCIPLINE CURRICULUM

Edition: 10

Date: 10.04.2024

Page. 3/16

- **To name** the groups of drugs: definition, classification;
 - **To recognize** the affiliation of the drugs to certain groups of chemical compounds; pharmacodynamics of substances (mechanism and site of action, effects, indications, contraindications, side effects and toxicity), pharmacokinetics of substances (route of administration, elimination), comparative characteristics of drugs;
 - **To find possibilities** of using drugs for medical purposes based on the knowledge of their properties.
- ✓ *at the application level student will be able:*
- **To select** and prescribe drugs in different diseases and pathological states;
 - **To demonstrate** pharmacological effects in experimental studies;
 - **To implement** the principles of cause and effect (dose-effect), benefit – injury;
 - **To solve** tests and problematic cases;
 - **To be able** to solve emergencies;
 - **To select** the most effective ways of drug administration based on their pharmacokinetic and pharmacodynamic properties, preventing interaction, incompatibility and complications of the medical treatment;
 - **To apply** rules of prescription and the prescription of drugs in all their medical forms;
 - **To prescribe** the medication of choice in various diseases and first of all in states of emergency, and depending on the pathogen, etc.;
 - **To apply** the dosing principles and determine the routes of administration of age-dependent drugs;
 - **To estimate** pharmacogenetically which drugs pose a risk to the patient in various enzymopathies;
 - **To estimate** the clinical picture and the basic symptoms in drug intoxications, first aid measures, antidotes and general principles of treatment, methods of neutralization of the toxic absorbed in the body and correction of disordered functions;
 - **To sketch** the biological standardization of the preparation;
 - **To use** the concomitant administration of several drugs without risk of incompatibility;
 - **To administer** the correct medicine depending on the biological rhythms;
 - **To apply** the theoretical knowledge to solve the situation problems, of the case - clinical problems;
 - Expressly modify a drug with another drug substance in the same group to minimize side effects and perform effective treatment;
 - **To apply** the method for determining the therapeutic index of the drug substance in experimental and clinical conditions, renal and hepatic clearance;
 - **To demonstrate** the dose-effect relationship and the bioavailability of the drug preparation;
 - **To operate** optimally in the provision of emergency assistance in situations of overdose or inadequate drug reactions.
- ✓ *at the integrated level:*
- **To assess** the importance and role of pharmacology in the context of general medicine and its integration into related disciplines;
 - **To integrate** medical and biological knowledge in learning pharmacology;
 - **To distinguish** the correlations between physiological and pathological processes and pharmacological properties of drugs;
 - **To form** basic principles of ethics and deontology in medical treatment (pharmacotherapy);
 - **To propose** research programs to develop new drugs and study further known medical substances;
 - **To integrate** the acquired knowledge of pharmacology in clinical disciplines;
 - **To be able** to acquire pharmacological news;



CD 8.5.1 DISCIPLINE CURRICULUM

Edition: 10

Date: 10.04.2024

Page. 4/16

IV. PROVISIONAL TERMS AND CONDITIONS

Students of third year have to know the following:

Pharmacology is a preclinical discipline studied at universities, contributing to obtaining basic knowledge of pharmacokinetics and pharmacodynamics of drugs, to be able to prescribe these properly, effectively and safely in the treatment of various diseases and pathological states; to obtain necessary information for a correct choice of drugs and their rational use; to foresee and prevent side effects of pharmacological therapy; to develop necessary skills to avoid drug poisoning and to deal with emergency cases quickly and properly.

Pharmacology is a field of medicine that is constantly developing and reflects the progress in medical, biological, technical and pharmaceutical sciences. As a result, several new, original drugs and hundreds of generic drugs in different medical forms with new commercial names appear on the pharmaceutical market annually. Nowadays, there are about 50,000 drugs and their systematization becomes more and more difficult. Pharmacology helps students to systematize the most important groups of drugs, to consider the action of drugs based on their pharmacological properties, mechanisms and place of action; to understand possibilities of using drugs for medical purposes based on the knowledge of their properties; to be able to prescribe drugs in different diseases and pathological states, especially in emergency situations, taking pharmacokinetics and pharmacodynamics of the drugs into consideration. To achieve them, the student must have the following skills:

- Confirmed competences in previous medical-biological sciences (molecular biology, chemistry and biochemistry, physiology, anatomy, medical terminology), as well as tangent sciences (pathological anatomy, pathophysiology, semiology of internal and surgical diseases);
- digital competences (use of the Internet, document processing, electronic tables and presentations, use of graphics programs);
- ability to communicate and do team work;
- qualities – compliance, perseverance, fairness, tolerance, compassion, autonomy.

TOPICS AND INDICATIVE DISTRIBUTION OF HOURS

Lectures, practical lessons/seminars and individual work

	Topics	Number of hours		
		Lectures	Practical lessons /seminars	Individual work
1.	Pharmacology and its importance. Its relations with other disciplines. The main parts and branches of pharmacology. Drug development. History of national pharmacology.	2	-	-
2.	Prescription order. Introduction. Solid medicinal forms.	-	3	4
3.	Semisolid (soft) medicinal drugs. Medicinal forms with modified distribution (part I).	-	3	4
4.	Liquid and injectable medicinal drugs. Medicinal forms with modified distribution (part II).	-	3	4
5.	General pharmacokinetics. Pharmacogenetics. General pharmacodynamics.	2	3	4
6.	Test: Medicinal Prescriptions. General pharmacology.		3	2



CD 8.5.1 DISCIPLINE CURRICULUM

Edition: 10

Date: 10.04.2024

Page. 5/16

7.	Adrenomimetics and dopaminomimetics.	2	3	3
8.	Adrenoblockers, dopaminoblockers and symphatholytics.	2	3	3
9.	Cholinomimetics and anticholinesterases. Cholinoblockers.	4	3	3
10.	Local anesthetics. Astringent, mucilaginous, adsorbent and irritating drugs.	2		2
11.	Test: Neurotrope: Remedies influencing peripheral innervation.		3	2
12.	Opioid and nonopioid analgesics. General anesthetics.	2	3	3
13.	Ethanol. Hypnotics, anticonvulsants, antiepileptics, antiparkinsonic drugs, the antispasmodics of the striated muscles.	2	3	2
14.	Psycholeptics: Antipsychotics. Anxiolytics. Sedatives. Lithium salts.	2	3	2
15.	Psychoanaleptics: Antidepressants. CNS Excitants. Nootropics. Analeptics. General tonisants and adaptogene drugs.	2	3	2
16.	Test: "Drugs with an influence on the CNS"		3	2
17.	Drugs with action on the functions of the respiratory system.	2	3	3
18.	Cardiotonic and cardiostimulatoting drugs.	2	3	3
19.	Antiarrhythmics, regional and local vasodilators.	2	3	3
20.	Drugs with systemic vasodilation (antihypertensive) and vasoconstrictive effect. (antihypotensive).	2	3	3
21.	Cerebral and peripheral vasodilator, antimigraine and venotropic drugs.	2		2
22.	Diuretics. Drugs used in nephrolithiasis, gout treatment and their influence on the acid- base balance.	2	3	2
23.	Drugs with action on the functions of the digestive tube. Spasmolytic drugs.	2	6	2
24.	Test: "Drugs acting on effector functions of organs and systems" Drugs acting on the respiratory, cardiovascular and digestive system, diuretics".		3	2
25.	Antiseptic and disinfectant drugs. Sulfamides. Antibacterial chemotherapeutics with different chemical structure.	2	3	2



CD 8.5.1 DISCIPLINE CURRICULUM

Edition: 10

Date: 10.04.2024

Page. 6/16

26.	Antibiotics.	2	3	3
27.	Antiviral, antimicotic drugs. Antispirochete drugs	2	3	3
28.	Antituberculous and antileprous drugs, antiprotozoal and antihelminthic drugs.	2	3	2
29.	Test: „Antimicrobial and antiparasitic drugs”.		3	2
30.	Antiinflammatory drugs.	2	1,5	3
31.	Antiallergic drugs with influence on the immune processes.	2	1,5	3
32.	Hormonal and antihormonal drugs p.I.	2	1,5	3
33.	Hormonal and antihormonal drugs p.II. Oxytoxins and tocolytics.	2	1,5	3
34.	Vitamin, enzyme and anti-enzyme preparations. Preparations used in hyperlipidemia (antiatherosclerotic), obesity and osteoporosis.	2		3
35.	Test: “Drugs affecting inflammatory, immune and metabolic processes”.		3	2
36.	Antineoplastic, radioprotective, radiopaque preparations. Adverse drug reactions. The basic principles of acute poisoning treatment. Drug interaction.	2		2
	Total	60	90	90

VI. PRACTICAL TOOLS PURCHASED AT THE END OF THE COURSE

- **to know** the structure of the prescription and fill in the prescription forms;
- **to prescribe** medicines in medicinal forms of delivery;
- **to use** specific pharmacological terminology in the study of clinical disciplines;
- **to select** the appropriate groups and preparations, medicinal forms and routes of administration in diseases and emergency pathological conditions;
- **to train** working skills with scientific literature in the field of pharmacology.

Note: The essential practical skills characteristic of the discipline, which are mandatory, will be listed acquired by each student during the module. These will serve as the basis for the practical skills evaluation stage and will constitute their portfolio per study program.



CD 8.5.1 DISCIPLINE CURRICULUM

Edition: 10

Date: 10.04.2024

Page. 7/16

VII. REFERENCE OBJECTIVES AND CONTENT UNITS

Objectives	Content units
Theme (chapter I) "Medical prescription and medicinal forms with modified distribution. General pharmacology"	
<ul style="list-style-type: none"> ● To define the general concepts specific to the general prescription; ● To know the names and nomenclature of medicines, structure of prescription, the prescription forms and the particularities of completing them; ● Demonstrate the prescription of medicines in solid, semisolid, liquid, injectable and gaseous medicinal forms; ● To apply knowledge in the field of new medicinal forms (prolonged release forms, nanoparticles, etc.) when prescribing treatment. ● To define the notions of pharmacokinetics, pharmacodynamics, pharmacogenetics; ● To know the main parameters of pharmacokinetics, mechanisms and laws of absorption, distribution, metabolism and elimination of drugs, the fields of study of pharmacogenetics; ● To demonstrate ability to interpret the pharmacodynamic principles of medicines; ● To operate with the notion of doses and its varieties; to apply the knowledge gained to the study of special pharmacology and other disciplines. ● To interpret the phenomena of the associated and repeated administration of drugs; 	<p>Orders regulating the prescription and release of medicines. Notions of drugs, composition of drugs, keeping of drugs.</p> <p>Chemical, official, common international, commercial names.</p> <p>Prescriptions and components. Forms of prescriptions.</p> <p>Officinal and masterly forms of prescription of medicinal forms. Solid, semisolid, liquid, injectable and gaseous medicinal forms. New drug forms with modified prescription.</p> <p>Objectives of pharmacokinetics, pharmacogenetics, pharmacodynamics.</p>
Theme (chapter II) "Drugs with influence on peripheral innervation"	
<ul style="list-style-type: none"> ● To define pharmacological groups and principles of classification; ● To know the pharmacodynamic and pharmacokinetic peculiarities of the groups of drugs, the mechanisms of achieving the pharmacological effects; ● To know the indications, contraindications, adverse reactions of drug groups, the clinical picture of intoxications and the principles of treatment; ● To demonstrate the skills of analysis and synthesis when solving tables, schemes and situational problems; ● To apply the particularities of prescribing medicines and selecting drugs in diseases and pathological conditions; ● To integrate the accumulated material in solving clinical cases. 	<p>Adrenomimetics and dopamineomimetics.</p> <p>Adrenoblockers, dopaminoblockers and sympatholytics.</p> <p>Cholinomimetics and anticholinesterases.</p> <p>Cholinoblockers. Local anesthetics.</p> <p>Astringent, mucilaginous, adsorbent and irritating preparations.</p>
Theme (chapter III) "Drugs influencing the CNS"	
<ul style="list-style-type: none"> ● To define pharmacological groups and classification principles; ● To know the pharmacodynamic and pharmacokinetic 	<p>Opioid and nonopioid analgesics.</p> <p>General anesthetics. Ethanol.</p>



CD 8.5.1 DISCIPLINE CURRICULUM

Edition: 10

Date: 10.04.2024

Page: 8/16

Objectives	Content units
<p>peculiarities of the groups of preparations, the mechanisms of achieving the pharmacological effects;</p> <ul style="list-style-type: none"> ● To know the indications, contraindications, adverse reactions of drug groups, the clinical picture of intoxications and the principles of treatment; ● To demonstrate the skills of analysis and synthesis when solving tables, schemes and situational problems; ● To apply the particularities of prescribing medicines and selecting preparations in diseases and pathological conditions; ● To integrate the accumulated material in solving clinical cases. ● To define the pharmacological groups and classification principles; ● To know the pharmacodynamic and pharmacokinetic peculiarities of the groups of preparations, the mechanisms of achieving the pharmacological effects; ● To know the indications, contraindications, adverse reactions of drug groups, the clinical picture of intoxications and the principles of treatment; ● To demonstrate the skills of analysis and synthesis when solving tables, schemes and situational problems; ● To apply the particularities of prescribing medicines and selecting preparations in diseases and pathological conditions; ● To integrate the accumulated material in solving clinical cases. 	<p>Hypnotics, anticonvulsants, antiepileptics, antiparkinsonian drugs, striated muscle antispasmodics.</p> <p>Psycholeptics: Antipsychotics. Anxiolytics. Sedatives. Thymoisoleptics.</p> <p>Psychoanaleptics: Antidepressants. SNC exitants. Nootropics. Analeptics.</p> <p>General and adaptive tonic drugs.</p> <p>Antithrombotic preparations (anticoagulants, antiaggregants, fibrinolytics). Preparations with hemostasis action (local and systemic) and with action on hematopoietic organs.</p>
Theme (chapter IV) “Drugs influencing on functions of effector organs and systems”	
<ul style="list-style-type: none"> ● To define the pharmacological groups and classification principles; ● To know the pharmacodynamic and pharmacokinetic peculiarities of the groups of preparations, the mechanisms of achieving the pharmacological effects; ● To know the indications, contraindications, adverse reactions of drug groups, the clinical picture of intoxications and the principles of treatment; ● To demonstrate the skills of analysis and synthesis when solving tables, schemes and situational problems; ● To apply the particularities of prescribing medicines and selecting preparations in diseases and pathological conditions; ● To integrate the accumulated material in solving clinical cases. 	<p>Drugs that act on respiratory system functions.</p> <p>Tonicardic glycosides and cardiostimulating drugs. Antiarrhythmic and antianginal drugs.</p> <p>Systemic vasodilators (antihypertensives). Systemic vasoconstrictors (antihypotensive).</p> <p>Drugs used in the treatment of cerebral and peripheral vascular circulation disorders. Antimigraine. Venotropes. Diuretics. Antigout drugs. Drugs used in urolithiasis.</p> <p>The drugs used in hydro-electrolytic and acid-base balance disorders. Plasma volume substitutes. Preparations with action on the functions of the digestive tract. Spasmolytic drugs.</p>



CD 8.5.1 DISCIPLINE CURRICULUM

Edition:	10
Date:	10.04.2024
Page. 9/16	

Objectives	Content units
Theme (chapter V) „Antimicrobial and antiparasitic drugs”	
<ul style="list-style-type: none"> ● To define pharmacological groups and classification principles; ● To know the pharmacodynamic and pharmacokinetic peculiarities of the groups of preparations, the mechanisms of achieving the pharmacological effects; ● To know the indications, contraindications, adverse reactions of drug groups, the clinical picture of intoxications and the principles of treatment; ● To demonstrate the skills of analysis and synthesis when solving tables, schemes and situational problems; ● To apply the particularities of prescribing medicines and selecting antimicrobial and antiparasitic preparations in diseases and pathological conditions; ● To integrate the accumulated material in solving clinical cases. 	Antiseptic and disinfectant preparations. Sulfamides. Antibacterial chemotherapeutics with diverse chemical structure. Antibiotics. Antiviral, antimycotic, antispirechete preparations. Antituberculosis, antileprosy, antiprotozoal, anthelmintic preparations.
Theme (chapter VI). ”Drugs influencing inflammatory, metabolic and immune systems”	
<ul style="list-style-type: none"> ● To define the pharmacological groups and classification principles; ● To know the pharmacodynamic and pharmacokinetic peculiarities of the groups of preparations, the mechanisms of achieving the pharmacological effects; ● To know the indications, contraindications, adverse reactions of drug groups, the clinical picture of intoxications and the principles of treatment; ● To demonstrate the skills of analysis and synthesis when solving tables, schemes and situational problems; ● To apply the particularities of prescribing medicines and selecting preparations in diseases and pathological conditions; ● To integrate the accumulated material in solving clinical cases. 	Anti-inflammatory preparations. Antiallergic preparations and with influence on immune processes. Hormonal and antihormonal preparations (p.I). Hormonal and antihormonal preparations (p. II). Oxytocin drugs and tocolytics. Vitamins, enzymes and anti-enzymes. Preparations used in obesity, hyperlipidemia (anti-atherosclerotic), osteoporosis. Antineoplastic, radio-protective, radiopaque preparations. Adverse reactions. The basic principles of acute poisoning treatment. Drug interaction.

VIII. PROFESSIONAL (SPECIFIC (SC)) AND TRANSVERSAL (TC) COMPETENCES AND STUDY OUTCOMES

Professional (specific) (SC) competences:

- **CP1.** Responsible execution of professional tasks with the application of the values and norms of professional ethics, as well as the provisions of the actual legislation in force.
- **CP2.** Adequate knowledge of the sciences about the structure of the body, physiological functions and behavior of the human body in various physiological and pathological conditions, as well as the relationships between health, physical and social environment.
- **CP5.** Interdisciplinary integration of the doctor's activity in a team with efficient use of all resources.
- **CP6.** Carrying out scientific research in the field of health and other branches of science.



CD 8.5.1 DISCIPLINE CURRICULUM

Edition: 10

Date: 10.04.2024

Page. 10/16

•CT1. Autonomy and responsibility in the activity.

FINALITY OF THE STUDY

Note. Study outcomes (are deduced from the professional competencies and formative valences of the informational content of the discipline).

At the end of the course Pharmacology the student will be able to:

- **Define** the principles of classifications of medicinal drugs
- **Know** the particularities of prescribing drugs in their different forms
- **Know** the general principles of pharmacokinetics, pharmacogenetics and pharmacodynamics;
- **Characterize** drug groups according to pharmacodynamic and pharmacokinetic properties;
- **Acquire** the prescription of prescriptive preparations and the selection of drugs in diseases and pathological conditions;
- **Understand** the necessity of material from previous subjects and tangents for assessing knowledge about pharmacology
- **Understand** the importance and necessity of knowledge about the drugs for professional activity;
- **Develop** skills to use knowledge in conducting tests, tables and problem situations;
- **Be able** to implement the knowledge gained in the research activity.

IX. STUDENT'S SELF-TRAINING

The student's individual work is divided into 2 stages:

1. individual auditory work, which includes:

- familiarizing the student with drug samples;
- solving homework tests;
- solving schemes and virtual cases;
- demonstrating knowledge when selecting groups and preparations in diseases and pathological conditions.

2. individual non-auditory work includes: performing general and medical prescription exercises, completing tables and solving situational problems to consolidate knowledge in special pharmacology topics (according to the table below);

Nr .	Expected product	Implementation strategies	Assessment criteria	Implementation terms
	<i>Exercises of general prescription</i>	Prescription of mandatory drugs in all forms of delivery exposed in the methodical indication with the prescription of recipes according to the rules studied in the general recipe. In the signature, the route of administration and the pathology in which the drug will be used will be indicated.	Evaluation of the correctness of the prescription of medicinal forms, the routes of administration and the pathologies in which they are prescribed.	September-May
	<i>Exercises of general prescription</i>	1) Preliminary analysis of the information on the respective topic from the lecture and manual with the Enumeration of groups and	Evaluation of the correctness of the selection of groups and drugs from the respective topic in diseases and	September-May



CD 8.5.1 DISCIPLINE CURRICULUM

Edition: 10

Date: 10.04.2024

Page. 11/16

Nr .	Expected product	Implementation strategies	Assessment criteria	Implementation terms
		drugs from the respective topic used in (for) various diseases and pathological conditions.	pathological conditions and the ability to argue the selection made.	
	<i>Completing the tables to consolidate knowledge</i>	Completing the tables to consolidate knowledge by studying the topic material in the course and the manual for the respective topic. Agreeing to complete the tables with the questions from the methodical instructions for the respective topic for highlighting the essential moments of the theme.	Appreciation of the degree of understanding of the different subjects included in the tables, the level of argumentation and the quality of the information, elements of creativity, demonstrating the understanding and appropriation of the theme.	September-May
	<i>Solving situational problems to reinforce knowledge.</i>	Prior study of the course and the material from the textbook on the respective topic to solve situational problems. Formation of elements of logical and clinical thinking.	Appreciation of the degree of understanding of the material and involvement of the student in applying the knowledge from the respective topic in solving the situational problems, as well as the level of argumentation of the rationality of the selection.	September-May

Informative note! The grade for individual work will be calculated based on the following criteria:

- 1) general recipe exercises (to prescribe mandatory preparations in recipes) – 0-3 points;
- 2) medical prescription exercises (to list the groups and preparations used in (for) – 0-4 points;
- 3) completing the tables (to consolidate knowledge) – 0-2 points;
- 4) solving situation problems – 0-1 point.

Suggestions for the student's individual activity:

- For creativity and logical acquisition of pharmacology it is necessary to:
- ✓ Take notes in class on key points of the topic and new material not available in the textbook.
- ✓ Do the individual non-auditory self-study work after prior study of the material presented in the textbook and in the course with the rigorous explanations of the lecturer.
- ✓ The immediate realization of consistent individual work that will allow you to adequately and rationally select the answers to the general and medical prescription exercises, fill in the tables and solve the situational problems.
- ✓ That being said, a skilled student should work individually for at least 5-7 hours a week for the sufficient acquisition of pharmacology.

X. METHODOLOGICAL SUGGESTIONS FOR TEACHING-LEARNING-ASSESSMENT

- **Teaching and learning methods used**



CD 8.5.1 DISCIPLINE CURRICULUM

Edition:	10
Date:	10.04.2024
Page. 12/16	

The pharmacology discipline is taught in a mixed manner, using classical methods and interactive methods of teaching-learning-evaluation: with lectures and practical works/seminars, which will follow various methods, both traditional and interactive. Lectures are read by the professors of the department. At practical seminars students deepen, and summarize theoretical knowledge acquired during the lectures and self-learning. It is necessary to mention that at the lectures students become familiar with the material. The role of practical seminars is to transform the process of familiarization and perception in learning.

Laboratory work is designed to provide students with research skills, including certain methods of research and scientific analysis. Laboratory work forms skills and professional knowledge. During practical seminars, students are taught to form their own opinion, to insist on it, and to appreciate other opinions. The goal of laboratory work is also to check student's knowledge on a current theme.

Through the use of interactive methods, students' learning and personal development are stimulated, promoting the exchange of ideas, experiences and knowledge, ensuring the active participation of students in discussing the topics, promoting interaction between students with different degrees of mastery of the topic, leading to active learning with obvious results, contributing to the improvement of the quality of the instructional-educational process, with character active-participative, a real active-formative value on the personality of students in the field of medicine.

For the effective use of these methods, during the seminars, interactive methods are used in interrelationship with traditional methods. This way of teaching transforms the student into an actor, an active participant in the learning process, prepared to acquire knowledge through his own effort, an optimal engagement of thinking, mobilizing him in relation to the given learning tasks, identifies himself with the learning situation in which it is trained, being an active part of its own transformation and training, generated by knowledge.

The teaching practice in Pharmacology based on interactive methods involves:

- direct verbal and socio-emotional interactions between students, grace to which transferable intellectual and social skills are developed in different formal or informal contexts;
- open attitude, active, based on personal initiative;
- active-participatory learning in collaboration with other colleagues;
- the intense engagement of students in completing the tasks;
- the collective and individual responsibility;
- valuing intellectual and verbal exchanges, relying on a logic of learning that takes into account student opinions.

When choosing a method, account is taken of the aims of the discipline, the content of the instructional-didactic process, the individual characteristics of the students, the psychosociology of student groups, the nature of the teaching aids.

During the year of study in Pharmacology, the following is used:

A. traditional didactic strategies: exposition, didactic explanation, conversation, demonstration, problematization, modeling, systematic observation, personal reflection, independent activity.

B. interactive teaching methods:

The lesson (course) and the seminars/laboratory works are structured according to the stages and with the use of modern teaching-learning-evaluation methods:

1. The **evocation** stage includes the organizational moment of greeting (1-2 min. and the explanation of unclear questions 5-7 min.) with the initiation of the subsequent discussion of the topic using modern methods (e.g. Brainstorming, free associations, I know-I want to know-I learned).
2. **Meaning making** stage - giving individual and collective feedback using methods (eg. Guided discussion, presentation, constructive controversy, categorical generalization, the Cube).
3. At the **reflection** stage (e.g. Venn diagram, case study, clusters, multi-process questioning)



CD 8.5.1 DISCIPLINE CURRICULUM

Edition: 10

Date: 10.04.2024

Page. 13/16

4. At the **expansion** stage (eg the poster, the set of molds, the experimental film).

The teaching aids used: tables, schemes, blackboard, marker, lecture, computers, modern televisions, multimedia, medicine samples: 1. Dosage forms: 7 sets of solid medicine forms (for each study room); 7 sets of liquid and gaseous medicinal forms (for each study room); 7 sets of soft medicine forms (for each study room); 7 sets of drugs from various pharmacological groups, according to the thematic plan; various tables on the wall and in the halls, drawings and schemes regarding the classification, types of action of drugs, indications, contraindications, adverse reactions; Prescription forms: form no. 1, 2, 3, etc. Reference literature "Medications"; Presentations about groups of medicinal preparations in each classroom; Methodological recommendations for students and teachers for seminars/laboratory works; Experimental films about the types of action of drugs.

frontal, individual, in teams.

In general, it can be said: the laboratory work must transform the student's statements from «I know» to «I can».

Before planning and, even more so, carrying out the laboratory work, the basic questions must be solved:

• **What should and what can be exposed in the laboratory work?**

First, the laboratory work reveals everything that is aimed at the formation of the student's professional skills and knowledge, secondly, the theoretical issues of primary importance for the acquisition of the object are discussed.

Based on the goals, what the laboratory work must solve is recommended: orientation consultations are held at the department for lecturers who support laboratory works, to decide what is the main thing in the given topic, how to assess the knowledge of the students, what new has appeared in this field, as well as assisting lecturers with other collaborators in order to unify the teaching process, exchange experience with those lecturers who have more seniority.

The laboratory work begins with the general characteristic of the topic, its actuality, determines the purpose and problems of the laboratory work, concretizes what the student must know, be able to do and what practical skills are necessary after studying the given topic for the acquisition of other topics in pharmacology, as well as reveals when studying which disciplines the given materials will be necessary and to what extent they are important for the practical work of the doctor.

At the same time, the lecturer highlights the students' difficulties in preparing for the laboratory work and answers all unclear questions. Here it is necessary to differentiate between the student who fully prepared and did not understand certain points (the lecturer must explain simply, accessible and as comprehensive as possible) and the student who did not prepare for the practical lesson and who wants to get the answers ready to one or another question. In this case, it is highlighted how the other students understood this question and if they understood, then the student, who asked the question, must be reminded of the methodology of working with the manual. The student's curiosity must be satisfied outside of laboratory hours.

Then follows the determination of the level of students' knowledge with the help of various interactive methods, where the student exposes what includes the classification of pharmacological remedies, the use of preparations in pathological conditions and diseases, and for mandatory preparations - the forms of delivery and the prescription of recipes, differentiation tests - what statements they contain from which he must choose only the correct ones. The work is carried out by recording the important moments in the workbook or oral interview.

The evaluation can be carried out by grid test or test-control on the computer using the program TEST-EDITOR or Moodle. The student is offered a variant of 20-25 tests on the respective topic. The evaluation is done by the computer, automatically or by the teacher in the case of the grid test.

This sample can be replaced by solving tests, virtual situations, crosswords, situational problems, case presentations, the characteristics of the mechanisms of action of preparations in the tables from the "Guide for laboratory work in pharmacology", developed by the department's collaborators in 2016.



CD 8.5.1 DISCIPLINE CURRICULUM

Edition: 10

Date: 10.04.2024

Page. 14/16

During the practical part, the lecturer demonstrates to the students some general practical elements and the sequence of actions. During the students' individual classroom work, the lecturer is in the room, supervises their work and gives advice.

As mentioned, the independent work must be constantly corrected and directed by the teaching staff.

The teacher controls the work of each student, analyzes the mistakes, appreciates the quality of the tasks, the consecutiveness of the solution of situational problems during the study of the independent material, prospectuses, demonstrative preparations. The lecturer highlights how the students learned the theory, how they understood and orientated themselves in the given material.

When the individual work is done, the teacher checks the written answers. If the student proved to be unprepared during the assessment of the initial level of knowledge, then he must be in the center of attention during the correction and consolidation of homework knowledge. So, the student must be coached several times in the discussion so that he can be included in the work group and start learning the material.

The individual auditory work may include solving 1-2 situational problems from methodical indications for laboratory work in pharmacology, completing or completing different tables, schemes, drawings, reading slides, solving situational problems.

During the viewing of the experimental tests (virtual films), in other cases (lack of films), the students are guided by the description of the experience in the "Guide to laboratory works" or supplement to the methodical indication for independent preparation of the respective topic. The description of the experience after their virtual visualization is written briefly with the respective conclusions, in the classroom notebooks.

Determining the level of knowledge using the interrogative method. At the beginning, the lecturer indicates the general principles of studying the topic, concrete drugs, the consecutiveness of their study, the comparative characteristics of the main groups of drugs, the particularities of their use and indications are discussed. When discussing the material, it is necessary to take into consideration the profiling of training at different faculties. For example, it is necessary to highlight the particularities of the action of the drugs in pregnant women, their effects in newborns, the dosage of the drugs in children, the causes of poisoning in children, the measures of prophylaxis and treatment of poisoning.

It is recommended to ask the question, take a break, then name the executor. All students must participate in correcting, concretizing and completing the answer. The lecturer appeals to the opinion of those present.

It is not allowed to divide students into active and passive. The system of questions, the content of the microseminar is determined by the lecturer until the laboratory work. The discussion is not recommended from the beginning with the weak student, as well as with the strong one. Better with the average ones (the student's curiosity must be satisfied outside the laboratory hours). The capable student should be interrogated with more complex questions, to prevent his boredom.

Generalization of the basic topics of the theme. The lecturer generalizes the key points from the topic, analyzes and exposes the most difficult elements, mistakes and other inaccuracies, which were admitted in the process of the work.

Virtual practical work.

The last stage is the determination of the students' final level of knowledge. For this, level II tests will be used, clinical cases, various situations that highlight the student's complex thinking, the appreciation of correct statements and logical connections, complex situation problems. The assessment of the student with a grade is determined by the reasoned and correct answers, but also by his active participation during their involvement in discussions using the interrogative method, group work or the application of other teaching methods during the seminar.

• **Applied didactic strategies/technologies (discipline-specific)**

Applied didactic strategies/technologies specific to the discipline of Pharmacology, involve the use of



CD 8.5.1 DISCIPLINE CURRICULUM

Edition: 10

Date: 10.04.2024

Page. 15/16

both traditional methods (lectures in PPT, practical exercises using didactic materials) and modern educational technologies using interactive forms of teaching using professional software for the creation and electronic maintenance of databases in the field of medicine; Virtual practical work. Computerized test programs. Demonstration of didactic (experimental) films. Multimedia programs, courses/seminars with photo, audio and video materials on the proposed topics.

Methods of assessment (including the method of final mark calculation)

Current: frontal and / or individual control through:

In the Pharmacology discipline during the study year, there are 6 concluding test each composed of 3 parts: the practical, theoretical part and individual work (formative assessment) as follows::

Concluding Test Nr.1: *Prescription of drugs in different forms (Written)*

General pharmacology (Written or oral + computer test)

Concluding Test Nr. 2: *Neurotropics: Drugs influencing peripheral innervations (Written or oral + computer test)*

Concluding Test a Nr.3: *Drugs influencing CNS. (Written or oral + computer test)*

Concluding Test Nr.4: *Drugs acting of effector functions of organs and systems (Written or oral + computer test)*

Concluding Test Nr.5: *Antibacterial and antiparasitic drugs (Written or oral + computer test)*

Concluding Test Nr.6: *Drugs affecting inflammatory, immune and metabolic processes (Written or oral + computer test)*

Appreciation of the degree of understanding of the material and involvement of the student in applying the knowledge from the respective topic in solving the situational problems, as well as the level of argumentation of the rationality of the selection. Thus, the formative assessment consists of 18 total tests , of which 6 evaluations are grid tests or computerized tests in the program "TEST-EDITOR", google.forms or Moodle; 6 assessments of practical skills in writing/oral and/or in the google.forms system, Moodle, etc. All tests are graded from 0 to 10. The computerized test is automatically graded by the program "TEST-EDITOR" or google.forms or Moodle. The computerized tests consist of 25-50 questions each (simple compliment and multiple compliment), which are timed with 25-50 minutes; 6 evaluations include the student's individual work, with marking according to the criteria established in the table in the "Individual work" compartment. Each test can be repeated written/oral/computerized and supported 2 times in the interval "from one totalization to another" and is graded from 0 to 10.

This fact determines, that the student supports the totalizations systematically, on time. The annual average is formed from the sum of the points accumulated during the study year in the written/oral tests/individual work divided by the number of tests multiplied by the coefficient 0.5.

The final:

Students who did not pass all oral/written tests/individual work with a positive grade, as well as those who did not recover absences from practical work and lectures, are not admitted to the promotion exams (semester 5 and 6) in the Pharmacology discipline. The exam in the Pharmacology discipline is made up of the annual average grade (coefficient 0.5) and the grade for taking the tests in the SIMU system (coefficient 0.5). The semester average grade will be calculated based on the average of 3 totals, each of 3 grades (practical part (recipe), theoretical part (written or test), individual work grade). The exam grade in SIMU will be assessed by solving 50 tests (simple and multiple completion).

The subjects for the exams are approved at the department meeting, at the Methodical Commission of the Department of Methodological-Biological Disciplines and are made known to the students one month before the session.

Method of mark rounding at different assessment stages

Intermediate marks scale (annual average, marks from the	National Assessment	ECTS Equivalent
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CD 8.5.1 DISCIPLINE CURRICULUM

Edition: 10

Date: 10.04.2024

Page. 16/16

examination stages)	System	
1,00-3,00	2	F
3,01-4,99	4	FX
5,00	5	E
5,01-5,50	5,5	
5,51-6,0	6	
6,01-6,50	6,5	D
6,51-7,00	7	
7,01-7,50	7,5	C
7,51-8,00	8	
8,01-8,50	8,5	B
8,51-9,00	9	
9,01-9,50	9,5	A
9,51-10,0	10	

Absence on examination without good reason shall be recorded as "absent" and is equivalent to 0 (zero). The student has the right to re-take the exam twice.

X. RECOMMENDED LITERATURE:

A. Compulsory:

In English

1. Kharkevitch D. A. „Pharmacology”. CEP. Medicina, Chişinău, 2017
2. Ghicavii V.i et al. Prescription guide. Chişinău, Medicina, 2021.
3. Tripathi K.D. Essentials of pharmacology. Sevent edition. India. 2013, 1020p. Richard A. Harvey; Pamela C. Champe; Mary J. Mycek and other. Lippincott’s Illustrated Reviews, Pharmacology, 2nd edition. 2000, 5-edition 2018.

B. Additional literature

1. Ghicavii V., Bacinschi N., Guţu N., Stratu E., Gavriluţa V., Serbeniuc L., Chiriac T., Pogonea I. „Methodical indications for pharmacology laboratory works” CEP „Medicina”. Chişinău, 2011
2. Anthony J. Trevor; Bertman G. Katzung; Susan B. Masters. Katzung & Trevor’s Pharmacology. Examination & Board Review. Sixth edition, 2002, 2019.
3. H. P. Rang; M. M. Dale; J. M. Ritter Pharmacology, Fourth edition. Churchill Livingstone. 1999.
4. Alfred Goodman Gilman, Louis S. Goodman, Alfred Gilman. “The Pharmacological Basis of therapeutics”. Mc Graw Hill 2005, 2018.