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FACULTY OF MEDICINE

STUDY PROGRAM 0912.1 MEDICINE 2

CHAIR OF PHARMACOLOGY AND CLINICAL PHARMACOLOGY

APPROVED
at the meeting of the Commission for Quality Assurance and Evaluation of the Curriculum Faculty of Medicine 2
Minutes No. 1 of 16.09.21

Chairman _PhD, Associate Professor _____

Suman Serghei _____

APPROVED
at the Council meeting of the Faculty of Medicine 2
Minutes No. 1 of 21.09.21

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.3 din 15.09.2021
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:

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Chisinau, 2021

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 body.

The content of this subject is intended to form specific competences about drugs, including: prescription of drugs; basic compartmens 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 pharmacokinetcs 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 theorethical 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:** Romanian, Russian, English, French.
- ✓ **Beneficiaries:** students of III year, Faculty of Medicine 1 and Medicine 2, Specialty Medicine

II. MANAGEMENT OF THE DISCIPLINE

Code of discipline		**F.05.O.044 / F.06.O.052**	
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 specia 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;
- ✓ 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 knowledges 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, incompatability 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.;
- ✓ 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;
- ✓ Operate optimally in the provision of emergency assistance in situations of overdose or inadequate drug reactions.

➢ **at the integration 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:

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 and reflects the progress in medical, biological, technical and pharmaceutical sciences. As a result, several new, original drugs and hundreds of generical 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.

- ✓ Confirmed competences in precedent 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.

V. THEMES AND ESTIMATE ALLOCATION OF HOURS

Lectures, practical hours/ laboratory hours/seminars and self-training

Nb.	Topics	Number of hours		
		Lectures	Practical lessons /seminars	Self-training
1.	Pharmacology and its importance. Its relations with other disciplines. Development of drugs. Parts of Pharmacology and its main branches Pharmacology in Moldova. History.	**2**	**-**	**-**
2.	Prescription order. Introduction. Prescription of solid drugs.	**-**	**3**	**4**
3.	Semisolid drugs**.** Modified drug forms p.I.	**-**	**3**	**4**
4.	Liquid and injectable drugs. Modified drug forms p.II.	**-**	**3**	**4**
5.	General pharmacokinetics. Pharmacogenetics. General pharmacodynamics.	**2**	**3**	**4**
6	**Totalizare: *Prescriptions. General pharmacology*.**		**3**	**2**
7.	Cholinomimetics and anticholinesterases.	**2**	**3**	**3**
8.	Cholinoblockers.	**2**	**3**	**3**
9.	Adrenomimetics and dopaminomimetics. Adrenoblockers, dopaminoblockers and symphatholytics.	**4**	**3**	**2**
10.	General and local anesthetics. Astringent, mucilaginous, adsorbent and irritating drugs.	**2**		**2**
11.	**Totalizare: *Neurotrops: Remedies influencing peripheral innervation.***		**3**	**2**
12.	Opioid and nonopioid analgesics. General anesthetics.	**2**	**3**	**3**
13.	Ethanol. Hypnotics, anticonvulsants, antiepileptics, antiparkinsonic drugs.	**2**	**3**	**2**
14.	Psycholeptics: Antipsychotics. Anxiolytics. Sedatives. Lithium salts.	**2**	**3**	**2**
15.	Psychoanaleptics: Antidepressants. CNS Exitants. Nootropics. Analeptics. General tonic and adaptive drugs.	**2**	**3**	**2**
16.	**Totalizare*: "Drugs influencing the CNS.***		**3**	**2**
17.	Drugs influencing haematopoiesis, platelet aggregation, blood coagulability and fibrinolysis.	**4**	**3**	**2**
18	Drugs acting on respiratory system.	**2**	**3**	**3**
19.	Antiarrhythmics, regional and local vasodilators.	**2**	**3**	**3**
20.	Glycosides, cardiotonic and cardiostimulant drugs.	**2**	**3**	**3**
21.	Drugs with systemic vasodilation (antihypertensive) and vasoconstriction (antihypotensive).	**2**	**3**	**3**
22.	Cerebral and peripheral vasodilator, antimigraine and venotropic drugs.	**2**		**2**
23.	Diuretics. Drugs used in nephrolithiasis, gout treatment and their influence on the acid-base balance.	**2**	**3**	**2**
24.	Drugs acting upon the digestive system.	**4**	**6**	**2**
25.	**Totalizare*: "drugs acting on effecter functions of organs and systems"* Drugs acting on the respiratory, cardiovascular and digestive system, diuretics''.**		**3**	**2**
26.	Antiseptics and disinfectants. Sulfamides. Antibacterial drugs with diverse chemical structures. Antispirochetous drugs.	**2**	**3**	**2**
27.	Antibiotics.	**2**	**3**	**3**
28.	Antiviral and antimicotic drugs.	**2**	**3**	**3**
29.	Antituberculous and antileprous drugs, antiprotozoal and antihelmintic drugs.	**2**	**3**	**2**
30.	**Totalizare:„*Antimicrobal and antiparasitic drugs".***		**3**	**2**
31.	Antiinflammatory drugs.	**2**	**1,5**	**3**
32.	Antiallergic drugs with influence on the immune processes.	**2**	**1,5**	**3**
33.	Hormonal and antihormonal drugs p.I.	**2**	**1,5**	**3**
34.	Hormonal and antihormonal drugs p.II. Oxytoxins and tocolytics.	**2**	**1,5**	**3**
35.	Vitamin, enzyme and anti-enzyme preparations. Preparations used in hyperlipidemia (antiatherosclerotic), obesity and osteoporosis.	**2**		**3**
36.	**Totalizare:**"***Drugs affecting inflammatory, immune and metabolic processes".***		**3**	**2**
37.	Antineoplastic, radioprotective, radiopaque drugs. Side effects of drugs. Basic principles of treatment of acute intoxification. Interaction of drugs.	**2**		**2**
	Total	**60**	**90**	**90**

VII. OBJECTIVES AND CONTENT UNITS

Objectives	Content units
Theme (chapter I) „General prescription. General pharmacology."	
✓ to define the general concepts specific to the general prescription; ✓ to distinguish the names and nomenclature of drugs; ✓ to memorize the structure of the prescriptions, the prescription forms and the peculiarities of completing them; ✓ to demonstrate the prescription of drugs in solid, semi-solid, liquid, injectable and gaseous drug forms; ✓ to apply the 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, the mechanisms and laws of absorption, distribution, metabolism and elimination of drugs, fields of study of pharmacogenetics; ✓ demonstrate skills in interpreting the pharmacodynamic principles of drugs; ✓ 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 at the associated and repeated administration of drugs; ✓ to integrate the accumulated material in solving clinical cases.	Orders are ruling the prescription and release of medication. Notions of drugs, composition of drugs, keeping of drugs. Chemical, official, international, commercial names. Prescriptions and components. Formulary of prescriptions. Formal drug prescriptions. Solid, semi-solid, liquid, injectable and gaseous drug forms. New drug forms with modified-release. General principles of pharmacokinetics, pharmacogenetics, pharmacodynamics.
Theme (chapter II) "Neurotropics: drugs influencing the peripheral innervations"	
✓ to define pharmacological groups and classification principles; ✓ to know the pharmacodynamic and pharmacokinetic particularities of the groups of drugs, the mechanisms of achieving the pharmacological effects; ✓ to know the indications, contraindications, side effects of drug groups, the clinical picture of intoxications and the principles of treatment; ✓ to demonstrate the skills of analysis and synthesis when solving tables, diagrams and situation problems; ✓ to apply the particularities of prescribing drugs and selecting drugs in diseases and pathological conditions; ✓ To integrate the accumulated material in solving clinical cases.	Cholinomimetics and anticholinesterases. Cholinoblockers. Adrenomimetics and dopaminomimetics, Adrenoblockers and dopaminoblockers, sympatholytics. Local anesthetics. Astringent, mucilaginous, adsorbing and irritating drugs
Theme (chapter III) "Drugs influencing the CNS"	
✓ To define pharmacological groups and classification principles; ✓ To describe the pharmacodynamic and pharmacokinetic particularities of the groups of drugs; ✓ To distinguish the mechanisms for achieving pharmacological effects; ✓ To identify the indications, contraindications, side effects of drug groups, clinical picture of intoxications and treatment principles; ✓ To demonstrate the analysis and synthesis skills in solving tables, diagrams and situation problems; ✓ To name the peculiarities of prescribing drugs and selecting drugs for diseases and pathological conditions; ✓ To integrate the accumulated material in solving clinical cases.	General anesthetics. Opioid and nonopioid analgesics. Ethanol. Hypnotics, anticonvulsants, antiepileptics, antiparkinsonian drugs. Psycholeptics: antipsychotics. Anxiolytics. Sedatives. Lithium salts. Psychoanaleptics: Antidepressants. SNC exitants. Nootropics. Analeptics. General and adaptive tonic drugs.
Theme (chapter IV) "Drugs influencing on functions of effector organs and systems"	
✓ To define pharmacological groups and classification principles; ✓ To describe the pharmacodynamic and pharmacokinetic particularities of the groups of drugs; ✓ To distinguish the mechanisms for achieving the pharmacological effects; ✓ List the indications, contraindications, side effects of drug groups, the clinical picture of intoxications and treatment principles; ✓ To name the particularities of prescribing drugs and selecting drugs for diseases and pathological conditions; ✓ To demonstrate the analysis and synthesis skills in solving tables, diagrams and situation problems; ✓ To integrate the accumulated material in solving clinical cases.	Drugs with action on the functions of the respiratory system. Antiarrhythmic and antianginal preparations. Tonicardiac glycosides and cardiostimulating drugs. Systemic vasodilator (antihypertensive) and vasoconstrictor (antihypertensive) preparations. Regional vasodilator preparations. Diuretics. Drugs used in nephrolithiasis, gout treatment and influencing the acid-base balance. Drugs with action on the functions of the digestive tract.
Theme (chapter V)" Antimicrobal and antiparasitic drugs"	
✓ Define pharmacological groups and principles of classification ✓ know the pharmacodynamic and pharmacokinetic particularities of the groups of drugs ✓ understand the mechanisms for achieving pharmacological effects ✓ be familiar with indications, contraindications, side effects of drug groups, clinical picture of intoxications and treatment principles;	Antiseptics and disinfectants. Antibiotics.Sulfonamides. Antibacterial chemotherapeutics with various chemical structures. Antituberculosis drugs. Antileprosis drugs. Antiviral, antispyrochetous drugs, antimycotic drugs.

Objectives	Content units
✓ be familiar with the particularities of prescribing drugs and selecting drugs for diseases and pathological conditions; ✓ Analyze tables, schematics and problem situations; ✓ Integration of the material	Antiprotozoal and antihelmintic drugs. Antineoplastic, radioprotective, radiopaque drugs.
Theme (chapter VI). "Drugs influencing inflammatory, metabolic and immune systems"	
✓ To define pharmacological groups and classification principles; ✓ To describe the pharmacodynamic and pharmacokinetic particularities of the groups of drugs; ✓ To distinguish the mechanisms for achieving pharmacological effects; ✓ List the indications, contraindications, side effects of drug groups, clinical picture of intoxications and treatment principles; ✓ To recognize the particularities of prescribing drugs and selecting drugs for diseases and pathological conditions; ✓ To demonstrate the analysis and synthesis skills in solving tables, diagrams and situation problems; ✓ To integrate the accumulated material in solving clinical cases.	Drugs influencing haematopoiesis, platelet aggregation, blood coagulability and fibrinolysis. Anti-inflammatory medication. Antiallergic drugs influencing the immune processes. Hormonal and antihormonal drugs. Oxytocic and tocolitics. Vitamins. Enzymes used as a medicine. Antienzymes. Antiatherosclerotic (hypolipidemic) drugs. Drugs used in osteoporosis and obesity.

VII. PROFESSIONAL (CP) AND TRANSVERSAL (CT) COMPETENCES AND STUDY OUTCOMES

➢ Professional (CP) 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.

➢ TRANSVERSAL (CT) COMPETENCES

•**CT1.** Autonomy and responsability in the activity.

➢ STUDY FINALITIES

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 assesing 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.

VIII. STUDENT'S SELF-TRAINING

Nr.	Expected outcome	Strategies of achievement	Criteria of evaluation	Implementation terms
1.	Obligatory characterization of the main medicinal preparations	Examining (studying) the course and the material in the book about the subject. Studying the questions from the methodological guidelines. Studying of the complete material with emphasis on the specific topics according to the questions in the indication. Formulation of generalizations and conclusions according to the topic.	Ability to highlight the most essential and the ability to interpret the material	September- June
2	Filling the notebook of practical	1) Analysis of the material from the lecture and the book; 2) Formulation of characteristics	Workload, solving of tests, exercises of general and specific prescription, problematic situations, ability to	September- June

Nr.	Expected outcome	Strategies of achievement	Criteria of evaluation	Implementation terms
	lessons by each student itself	of obligatory drugs 3) Fulfilling exercises about general and specific drug prescription 4) Solving tables and problematic situations 5) Selecting additional information, using electronic addresses and additional bibliography	formulate conclusions	
3	Application of different methods of learning		workload, understanding of the essence of different subjects, level of scientific argumentation, quality of conclusions, elements of creativity, demonstration of understanding the problem, formation of personal attitude	September- June
4	Working with additional material	Self-evaluation in the process of self-training, study of materials from additional sources	Results of self-evaluation	September- June
5	Composing and giving presentations	Selection of the topic of research, establishment of the research plan, setting the terms of realization. Creating the PowerPoint presentation plan - topic, purpose, results, conclusions, practical applications, bibliography. Reviews of colleagues and teachers	workload, level of specificity about the topic of the project, level of scientific argumentation, quality of conclusions, elements of creativity, personal attitude formation, coherence of exposure and scientific correctness, presentation, presentation method	September- June

Suggestions for individual student activity:

If you want to succeed in the subject of pharmacology, follow the following steps:

Solve your homework by yourself. This includes: the characteristic of the mandatory drugs (in the form of a table), the prescription of these drugs in various forms and the selection of the most effective drugs depending on diseases and pathological conditions, all of which are based on a specific topic.

- Read the tests in the book "Self-Assessment Tests" and read the corresponding answers. This allows you to successfully pass the computer control test.
- Attend courses and practical lessons to become familiar with pharmacology and to learn how to properly arrange the material.
- Make notes during the lesson and compare this information with the material of other subjects.
- Organize time rationally. Pharmacology requires a lot of attention.
- For better learning, form small groups of 2-3 students to obtain a broader and clearer understanding of the material. In addition, the ability to explain the material you have learned to your collegues will be very helpful in the future.
- Once you've mastered going over the material using the recommended literature, try repeating without inspiration and checking. If you didnt succeed as well, then repeat once more using the phrase "Repetitio est mater studiorum"
- That said, a savvy scholar for pharmacology would have to work individually for at least 5-7 hours a week.

IX. METHODOLOGICAL SUGGESTIONS FOR TEACHING-LEARNING-ASSESSMENT

• Teaching and learning methods used

Pharmacology is taught in a classical manner: lectures and practical work. At practical seminars students deepen, and summarize theoretical knowledge acquired during the lectures and self-learning. The discipline of pharmacology is taught in the classical way: with lectures and laboratory works and seminars. The lectures use passive methods of transmitting knowledge through the use of new methods based on technical means with the presentation of diagrams of mechanisms of action, images and videos on adverse drug reactions or cases of intoxication. Lectures are read by the professors of the department. It is necessary to mention that at the lectures students become familiar with the material.

In the laboratory works, students deepen, broaden and detail their theoretical knowledge, acquired by the student in lectures (course) and in independent training. The role of the laboratory work consists in the transfer of the process of knowledge, perception in learning. The laboratory works use **passive methods** (control works, tests, oral interview, individual work), **active methods** (interaction process by asking questions, exposition of suggestions, ideas) and **interactive methods** (multimedia learning, brainstorming, play role, situation problems or clinical case, round table) teaching.

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.

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

Before planning a practical seminar, one must answer the basic questions:

Applied teaching strategies / technologies (specific to the discipline)

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

Firstly, the laboratory work reveals everything that is aimed at training students in professional skills and knowledge, secondly, it discusses theoretical issues of paramount importance for learning the subject and understanding clinical disciplines.

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

I,. Laboratory work begins with the general characterization of a theme and its relevance, determines purposes and problems of the laboratory work, and practical skills needed to study other new topics of pharmacology. It also reveals the degree of importance of knowledge of the theme for medical practice..

II.Simultaneously, teacher points out difficulties students may face during the preparation for laboratory work and answer any unclear questions. The teacher must differentiate well prepared students who didn't understand some moments (teacher must explain simply, easily and comprehensively) and the students who are not ready for practical lessons and want to receive answers to one or another question. Student's curiosity must be satisfied out of laboratory hours.

III. Then follows the determination of the initial level of knowledge of students through written testing, which includes the classification of pharmacological remedies, the use of drugs in pathological conditions and diseases, and for mandatory preparations - delivery forms and prescriptions, differentiation tests - containing statements from which they have to choose only the right variant. The work is in written form.

IV. Test-control using computer program TEST-EDITOR. Students are offered a choice of 15 tests. The computer appreciates the test automatically. This test can be replaced by solving tests, virtual situations, crosswords, situation problems, case presentations, the characteristics of the mechanisms of action of the drugs in the tables in the "Guide for laboratory work in pharmacology", developed by the department in 2016.

When performing the practical part, the lecturer demonstrates to the students some general practical elements and the sequence of actions. During the students' independent work, the lecturer is in the room, supervising their work and giving consultations.

As mentioned, the work in itself must be permanently corrected and directed by the professor. The lecturer controls the work of each student, analyzes the mistakes, appreciates the quality of fulfilling the report, the consecutiveness of solving the situation problems during the study of the independent material, the leaflets, the demonstrative preparations. The lecturer highlights how the students have mastered the theory, how they understood and orient themselves in the given material.

When the work is done independently, the professor checks the answers in writing form. If the student has 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 knowledge on the topic. So, such a student must be trained several times in the discussion in order for him to be included in the working group and to start mastering the material.

Independent work includes interactive methods of initial assessment by solving in groups of 2-3 students the situation problems from methodical indications for laboratory work in pharmacology, fulfilling or completing different tables, crosswords , diagrams, drawings, reading slides, clinical cases. Subsequently, through the interactive play role method, each group presents the concept made with the answer to the questions of the colleagues and the subsequent summary of the assimilated practical knowledge and skills.

V. Through the interactive multimedia learning method, which is achieved by watching experimental tests (virtual didactic films), students get involved by exposing opinions and comments on the results of didactic films with the elaboration of the respective conclusions.

II. The deeper level of knowledge is determined using the **passive method** (oral interview) and **active** (asking questions, presenting opinions, completions and ideas) to discuss the main aspects of groups of drugs and obligatory drugss, the peculiarities of prescribing drugs in different pathologies, principles of dosage, characteristic adverse reactions, intoxications and treatment principles.

It is recommended to ask the question, to do pause, then to call the executor. All students must participate in correcting, concretizing and completing the answer. The professor appeals to the opinion of those present.

It is not allowed to divide students into active and passive students. The question system, the content of the mycroseminar is determined by the lecturer until the laboratory work. The discussion is not recommended at the beginning with the weak student, as well as with the strong one. Better to start with the medium students (the student's curiosity must be satisfied outside of working hours). The able student should be asked more complex questions to prevent boredom.

VII. Generalization of the basic topics of the theme. Lecturer generalizes the key-moments of the subject, carried out the analysis and exposure of the most difficult elements, mistakes and other inaccuracies, which were admitted at the test control.

VIII. Virtual films are to supplement some essential moments of the subject by demonstrating the effects, the mechanisms of action.

IX. The last step is to determine the final level of knowledge of students. For this purpose will be used for level II tests, clinical cases, various situations that reveal the student's complex thinking, accurate claims assessment and logical links consisting of problem situations. Appreciation of students with marks should be based on argued and complete answers, but also on his active participation during their involvement in discussions according to the interrogative method, group work or the application of other teaching methods during the seminar.

Applied teaching strategies / technologies (specific to the discipline)

Virtual practical work. Computerized testing programs. Demonstration of didactic films.

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

Current: *frontal and / or individual control through:*

In the subject of pharmacology there are six "Totalizari" each composed of two parts (practical and theoretical) as follows:

Totalizarea Nr.1:*Prescription of drugs in different forms (Written) General pharmacology (*Written or oral + computer test*)*

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

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

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

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

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

Final: examen

Students who did not take all the oral / written tests on a positive marks as well as those who did not recover the absences from the practical works are not admitted to the promotion exams (semesters 5 and 6) for the pharmacology discipline. The exam in the discipline of Pharmacology consists of the general average mark multiplied by the coefficient of 0.5 and 0.5 after taking the tests in the SIMUs system, in the online regime according to the google.forms system.

The subjects for exams (tests, indications in diseases and pathological conditions, the list of compulsory drugs and questions for exams) are approved at the meeting of the department, at the Methodical Commission of the Department of Methodological-Biological Disciplines and are made known to students one month before the session.

Method of mark rounding at different assessment stages

Intermediate marks scale (annual average, marks from the examination stages)	National Assessment System	ECTS Equivalent
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
8,51-8,00	9	
9,01-9,50	9,5	A
9,51-10,0	10	

Annual average mark and grades of all stages of the final examination (computer-assisted, test, oral answer) - all will be expressed in numbers according to the grading scale (according to the table), and the final mark obtained will be expressed in numbers with two decimals, which will be entered in the notebook.
Absence on the exam without good motivation is recorded as "absent" and is equivalent to a grade of 0 (zero). The student has the right to re-take the exam twice.

XI. RECOMMENDED LITERATURE:

A. Compulsory:

In English

1. Kharkevitch D. A. „Pharmacology". CEP. Medicina, Chişinău, 2017
2. Ghicavîi V.i et al. Prescription guide. Chișinău, Medicina, 2021.
3. Ghicavîi 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
4. Richard A. Harvey; Pamela C. Champe; Mary J. Mycek and other. Lippincott's Illustrated Reviews, Pharmacology, 2nd edition. 2000, 5-edition 2018.
5. Anthony J. Trevor; Bertman G. Katzung; Susan B. Masters. Katzung & Trevor's Pharmacology. Examination & Board Review. Sixth edition, 2002, 2019.

B. Additional literature

1. Ghicavîi V., „" Medicamentul-beneficiu sau prejudiciu", Chișinău, 2009.
2. Cristea Aurelia –Nicoleta „Tratat de Farmacologie", Bucureşti, 2020
3. Medicamentele - baza farmacoterapiei raţionale (sub redacţia prof.univ. V.Ghicavîi). Chişinău, 2013
4. Ghicavîi V. şi al. "Farmacoterapia modernă a dereglărilor digestive", Chişinău, 2017
5. Stroescu V. „Bazele farmacologice ale practicii medicale". (vol. I, II) "Editura medicala", Bucureşti, 2004
6. Ghicavîi Victor „Medicamente şi utilizarea lor raţională", Chişinău, 2004
7. Muhin E., Ghicavîi V., Gonciar V., Bacinschi N., "Medicația dereglărilor circulației cerebrale și periferice", Chișinău, 1998
8. Ghicavîi V. "Medicamentul –beneficiu sau prejudiciu", I.S.F.E.P. "Tipigrafia Centrală", Chișinău, 2009
9. Ghicavîi V., Turcan L., Coreţchi Ianoș, Stratu E., "Cum procedăm în-...?", Chișinău, 2017
10. H. P. Rang; M. M. Dale; J. M. Ritter Pharmacology, Fouth edition. Chuchill Livingstone. 1999.
11. Alfred Goodman Gilman, Louis S. Goodman, Alfred Gilman. "The Pharmacological Basis of therapeutics". Mc Graw Hill 2005, 2018.