**МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ,**
**МИНИСТЕРСТВО НАУКИ, ВЫСШЕГО ОБРАЗОВАНИЯ И ИННОВАЦИЙ**
**КЫРГЫЗСКОЙ РЕСПУБЛИКИ**

МОО ВО Кыргызско-Российский Славянский университет
имени первого Президента Российской Федерации Б.Н. Ельцина

УТВЕРЖДАЮ
Директор ИКМиБТ
_____ Абилова СС.
04.11. 2026 г.

# ПРОФЕССИОНАЛЬНЫЙ ЦИКЛ
# Фармакология

## рабочая программа дисциплины (модуля)

Разработано **Базисной и клинической фармакологии, химии и биохимии**

Учебный план 310501_26_1 лд ин.plx
560001 Лечебное дело (Для иностранных студентов)

Квалификация **врач**

Форма обучения **очная**

Общая трудоемкость **7 ЗЕТ**

Часов по учебному плану 210

в том числе:

аудиторные занятия 112

самостоятельная работа 67,7

Виды контроля в семестрах:

зачет 3
экзамен 4

**Распределение часов дисциплины по семестрам**

| Семестр (<Курс>.<Семестр на курсе>) | **3 (2.1)** | | **4 (2.2)** | | Итого | |
|---|---|---|---|---|---|---|
| Недель | 18 | | 17 | | | |
| Вид занятий | УП | РП | УП | РП | УП | РП |
| Лекции | 32 | 32 | 16 | 16 | 48 | 48 |
| Практические | 32 | 32 | 32 | 32 | 64 | 64 |
| Контактная работа в период теоретического обучения | 0,3 | 0,3 | | | 0,3 | 0,3 |
| Контактная работа в период экзаменационной сессии | | | 0,5 | 0,5 | 0,5 | 0,5 |
| В том числе инт. | 6 | 6 | 6 | 6 | 12 | 12 |
| Итого ауд. | 64 | 64 | 48 | 48 | 112 | 112 |
| Контактная работа | 64,3 | 64,3 | 48,5 | 48,5 | 112,8 | 112,8 |
| Сам. работа | 25,7 | 25,7 | 42 | 42 | 67,7 | 67,7 |
| Часы на контроль | | | 29,5 | 29,5 | 29,5 | 29,5 |
| Итого | 90 | 90 | 120 | 120 | 210 | 210 |

Программу составил(и):
*MD, professor, Zurdinova A.A.;-, Senior lecturer KRSU, Satybaldieva A.T.*

Рецензент(ы):
*PhD, assistant professor, Jumagulova J.O.;PhD, chief od terapiutic department #1 KRSU, Suranova G.J.*

Approved by the HEP: Zhamankulova M.K.

Рабочая программа дисциплины
**Фармакология**

разработана в соответствии с ФГОС 3++:
Федеральный государственный образовательный стандарт высшего образования - специалитет по специальности 560001 Лечебное дело (Для иностранных студентов) (приказ Минобрнауки России от г. № )

составлена на основании учебного плана:

560001 Лечебное дело (Для иностранных студентов)

утвержденного учёным советом вуза от 26.06.2026 протокол № 11.

Рабочая программа одобрена на заседании department of basic and clinical pharmacology, chemistry and biochemistry

Протокол от 28.08.2026 г. № 1
Срок действия программы: 2026-2031 уч.г.
Руководитель подразделения: Zurdinova A.A.

# ЛИСТ РЕГИСТРАЦИИ ИЗМЕНЕНИЙ
# к рабочей программе дисциплины (модуля)

**Фармакология**

*наименование дисциплины*

| № п/п | Основание внесения изменения | Раздел/ пункт | Содержание изменения |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |

| 1. ЦЕЛИ ОСВОЕНИЯ ДИСЦИПЛИНЫ | |
|---|---|
| 1.1 | Studying of classifications of medicines, formation at students of skill of competent selection. The most effective and safe medicines according to their pharmacodynamic and pharmacokinetic characteristics, drug interactions; alertness to undesirable drug reactions for a given pathology and elimination of the consequences of these reactions; training of students in the methodology of mastering knowledge on pharmacology using scientific, reference literature, official statistical surveys, Internet resources and evidence-based principles; basics prescription document circulation and rules for writing prescriptions for medicines; Special attention is given to the formular system, the international nonproprietary (generic) name medicines. |

| 2. МЕСТО ДИСЦИПЛИНЫ В СТРУКТУРЕ ООП | |
|---|---|
| Цикл (раздел) ООП: | Б1.О.03 |
| **2.1** | **Требования к предварительной подготовке обучающегося:** |
| 2.1.1 | Химия (Математический и естественнонаучный цикл) |
| 2.1.2 | Гистология, эмбриология, цитология (Профессиональный цикл) |
| 2.1.3 | Анатомия человека (Профессиональный цикл) |
| 2.1.4 | Нормальная физиология (Профессиональный цикл) |
| 2.1.5 | Латинский язык (Гуманитарный, социальный и экономический цикл) |
| **2.2** | **Дисциплины и практики, для которых освоение данной дисциплины (модуля) необходимо как предшествующее:** |
| 2.2.1 | Педиатрия (Профессиональный цикл) |
| 2.2.2 | Б1.В.ДВ.09.01. Стандарты диагностики |
| 2.2.3 | Факультетская терапия (Профессиональный цикл) |
| 2.2.4 | Госпитальная терапия (Профессиональный цикл) |
| 2.2.5 | Клиническая фармакология (Профессиональный цикл) |

## 3. КОМПЕТЕНЦИИ ОБУЧАЮЩЕГОСЯ, ФОРМИРУЕМЫЕ В РЕЗУЛЬТАТЕ ОСВОЕНИЯ ДИСЦИПЛИНЫ (МОДУЛЯ)

**В результате освоения дисциплины обучающийся должен**

| **3.1** | **Знать:** |
|---|---|
| 3.1.1 | The basic concepts, objectives, and major branches of pharmacology and its importance in dental practice. |
| 3.1.2 | The fundamental principles of pharmacokinetics and pharmacodynamics. |
| 3.1.3 | The classification of medicinal products, their mechanisms of action, and major pharmacological effects. |
| 3.1.4 | The main routes of drug administration, absorption, distribution, metabolism, and excretion. |
| 3.1.5 | The pharmacological properties of drugs used in dentistry, including local anesthetics, analgesics, anti-inflammatory agents, antibacterial drugs, antifungal agents, antiviral drugs, and antiseptics. |
| 3.1.6 | The mechanisms of action and specific characteristics of local anesthetics, including their combination with vasoconstrictors. |
| 3.1.7 | The indications, contraindications, adverse drug reactions, and potential complications associated with medicinal products. |
| 3.1.8 | The main types of drug interactions and their clinical significance. |
| 3.1.9 | The principles of rational and safe use of medicines, including the prevention of polypharmacy and antimicrobial resistance. |
| 3.1.10 | The age-related and individual characteristics of drug action in children, pregnant women, elderly patients, and patients with concomitant diseases. |
| 3.1.11 | The fundamentals of medical prescription writing, dosage forms, and routes of drug administration. |
| 3.1.12 | The pharmacological principles of drug use in the rehabilitation of patients with dental diseases. |
| **3.2** | **Уметь:** |
| 3.2.1 | Identify the pharmacological group of a medicinal product based on its international nonproprietary name (INN). |
| 3.2.2 | Explain the mechanisms of action and major pharmacological effects of medicinal products. |
| 3.2.3 | Compare medicinal products within the same pharmacological group. |
| 3.2.4 | Substantiate the pharmacological choice of medicinal products based on their properties and relevance to dental practice. |
| 3.2.5 | Select appropriate dosage forms and routes of administration according to the pharmacological characteristics of a drug. |
| 3.2.6 | Calculate single, daily, and total treatment doses of medicinal products. |
| 3.2.7 | Identify contraindications, potential adverse drug reactions, and drug interactions. |
| 3.2.8 | Assess factors affecting drug efficacy and safety, including age, body weight, allergy history, and concomitant diseases. |
| 3.2.9 | Write prescriptions for the main medicinal products used in dental practice. |
| 3.2.10 | Use official prescribing information, pharmacological reference books, and scientific literature to evaluate medicinal products. |

| | |
|---|---|
| 3.2.11 | Identify potential pharmacological risks associated with the combined use of medicines and non-pharmacological treatment methods. |
| **3.3** | **Владеть:** |
| 3.3.1 | Performing pharmacological analysis of medicinal products used in dentistry. |
| 3.3.2 | Evaluating the mechanisms of action, pharmacological effects, and duration of action of medicinal products. |
| 3.3.3 | Selecting appropriate pharmacological groups of medicines for typical dental practice situations. |
| 3.3.4 | Calculating drug doses according to age, body weight, and dosage form. |
| 3.3.5 | Writing prescriptions for commonly used medicinal products. |
| 3.3.6 | Identifying and preventing adverse drug reactions and potentially harmful drug interactions. |
| 3.3.7 | Assessing the safety of local anesthetics, analgesics, anti-inflammatory agents, and antibacterial drugs. |
| 3.3.8 | Using pharmacological reference sources, official prescribing information, and scientific publications. |
| 3.3.9 | Applying the principles of rational and safe use of medicines in dental practice. |

**4. СТРУКТУРА И СОДЕРЖАНИЕ ДИСЦИПЛИНЫ (МОДУЛЯ)**

| Код занятия | Наименование разделов и тем /вид занятия/ | Семестр / Курс | Часов | Компетен-ции | Литература | Инте ракт. | Пр. подг. | Примечание |
|---|---|---|---|---|---|---|---|---|
| | **Раздел 1. General prescription** | | | | | | | |
| 1.1 | Solid dosage forms /Пр/ | 3 | 2 | | Э1 Э2 Э3 | 1 | | |
| 1.2 | Semisolid dosage forms /Пр/ | 3 | 2 | | Э1 Э2 Э3 | 1 | | |
| 1.3 | Liquid dosage forms /Пр/ | 3 | 2 | | Э1 Э2 Э3 | 1 | | |
| 1.4 | Independent work on the section "General prescription" /Ср/ | 3 | 6 | | Э1 Э2 Э3 | | | Preparation for control work on section "The total recipe", writing out of various forms medicines in recipes, calculations for number of medicinal substances |
| | **Раздел 2. General pharmacology** | | | | | | | |
| 2.1 | Introduction to pharmacology. History pharmacology. Problems of modern pharmacology /Лек/ | 3 | 2 | | Э1 Э2 Э3 | | | |
| 2.2 | General pharmacology:pharmacodynamics and pharmacokinetics /Лек/ | 3 | 2 | | Э1 Э2 Э3 | | | |
| 2.3 | Side effects of drugs /Лек/ | 3 | 2 | | Э1 Э2 Э3 | | | |
| 2.4 | General pharmacology:pharmacodynamics and pharmacokinetics /Пр/ | 3 | 2 | | Э1 Э2 Э3 | 1 | | |
| 2.5 | Side effects of drugs /Пр/ | 3 | 2 | | Э1 Э2 Э3 | 2 | | |
| 2.6 | Independent work on the section "General pharmacology " /Ср/ | 3 | 7,7 | | Э1 Э2 Э3 | | | Preparation for the colloquium on section "The general pharmacology" |
| | **Раздел 3. Drugs, affecting peripheral nervous system** | | | | | | | |
| 3.1 | Drugs, affecting afferent innervation /Лек/ | 3 | 2 | | Э1 Э2 Э3 | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 3.2 | Drugs, affecting afferent innervation:<br>local anesthetics, demulcents, adsorbents,astringent, irritating drugs /Пр/ | 3 | 2 | | Э1 Э2 Э3 | | | |
| 3.3 | Cholinergic drugs /Лек/ | 3 | 2 | | Э1 Э2 Э3 | | | |
| 3.4 | Cholinergic drugs /Пр/ | 3 | 2 | | Э1 Э2 Э3 | | | |
| 3.5 | Adrenergic drugs /Пр/ | 3 | 2 | | Э1 Э2 Э3 | | | |
| 3.6 | Adrenergic drugs /Лек/ | 3 | 2 | | Э1 Э2 Э3 | | | |
| 3.7 | Independent work on the section «Drugs,affecting peripheral nervous system» /Ср/ | 3 | 12 | | Э1 Э2 Э3 | | | Preparation for control work on section "Drugs, affecting peripherally nervous system",writing student's medicines formulary |
| | **Раздел 4. Drugs, affecting central nervous system** | | | | | | | |
| 4.1 | General anesthetics /Лек/ | 3 | 2 | | Э1 Э2 Э3 | | | |
| 4.2 | General anesthetics /Пр/ | 3 | 2 | | Э1 Э2 Э3 | | | |
| 4.3 | Sedative- hypnotics. Antiseizure drugs. Antiparkinson drugs /Лек/ | 3 | 2 | | Э1 Э2 Э3 | | | |
| 4.4 | Sedative- hypnotics. Antiseizure drugs. Antiparkinson drugs /Пр/ | 3 | 2 | | Э1 Э2 Э3 | | | |
| 4.5 | Analgetics /Лек/ | 3 | 2 | | Э1 Э2 Э3 | | | |
| 4.6 | Analgetics /Пр/ | 3 | 2 | | Э1 Э2 Э3 | | | |
| 4.7 | Central nervous system depressants /Лек/ | 3 | 2 | | Э1 Э2 Э3 | | | |
| 4.8 | Central nervous system depressants /Пр/ | 3 | 2 | | Э1 Э2 Э3 | | | |
| 4.9 | Central nervous system stimulants /Пр/ | 3 | 2 | | Э1 Э2 Э3 | | | |
| 4.10 | Independent work on the section « Drugs,<br>affecting central nervous system» /КрТО/ | 3 | 0,3 | | Э1 Э2 Э3 | | | Preparation for control work on section "Drugs, affecting central nervous system",writing student's medicines formulary |
| 4.11 | Central nervous system stimulants /Лек/ | 3 | 2 | | Э1 Э2 Э3 | | | |
| 4.12 | Modul "Medicines, affecting to peripheric and central nervous systems" /Пр/ | 3 | 4 | | | | | |
| | **Раздел 5. Drugs, affecting cardiovascular system** | | | | | | | |
| 5.1 | Cardiotonic drugs /Пр/ | 3 | 2 | | Э1 Э2 Э3 | | | |
| 5.2 | Antianginal drugs.<br>/Пр/ | 4 | 2 | | Э1 Э2 Э3 | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 5.3 | Antihypertensive drugs /Пр/ | 4 | 2 | | Э1 Э2 Э3 | | | |
| 5.4 | Independent work on the section «Drugs,affecting cardiovascular system» /Ср/ | 4 | 6 | | Э1 Э2 Э3 | | | Preparation for control work on section "Drugs, affecting cardiovascular system",writing student’s medicines formulary |
| 5.5 | Drugs, affecting cardiovascular system /Лек/ | 3 | 2 | | Э1 Э2 Э3 | | | |
| 5.6 | Lipid-lowering medicines /Пр/ | 4 | 2 | | Э1 Э2 Э3 | | | |
| | **Раздел 6. Drugs, affecting function of executive bodies and processes of tissue metabolism** | | | | | | | |
| 6.1 | Drugs, affecting the respiratory system /Лек/ | 3 | 2 | | Э1 Э2 Э3 | | | |
| 6.2 | Drugs, affecting the respiratory system /Пр/ | 4 | 2 | | Э1 Э2 Э3 | | | |
| 6.3 | Drugs, affecting the digestive system /Лек/ | 3 | 2 | | Э1 Э2 Э3 | | | |
| 6.4 | Drugs, affecting the digestive system /Пр/ | 4 | 2 | | Э1 Э2 Э3 | | | |
| 6.5 | Diuretics. Drugs, reducing the content in the body uric acid. Drugs, affecting on the tonus of the myometrium /Лек/ | 3 | 2 | | Э1 Э2 Э3 | | | |
| 6.6 | Diuretics. Drugs, reducing the content in the body uric acid. Drugs, affecting on the tonus of the myometrium /Пр/ | 4 | 2 | | Э1 Э2 Э3 | | | |
| 6.7 | Drugs, affecting the blood system /Лек/ | 3 | 2 | | Э1 Э2 Э3 | | | |
| 6.8 | Drugs, affecting the blood system /Пр/ | 4 | 2 | | Э1 Э2 Э3 | | | |
| 6.9 | Hormonal preparations, and their synthetic analogues, antagonists / Пр/ | 4 | 4 | | Э1 Э2 Э3 | 1 | | |
| 6.10 | Independent work on the section « Drugs,affecting function of executive bodies and processes of tissue metabolism » /Ср/ | 4 | 15 | | Э1 Э2 Э3 | | | Preparation for the colloquium on section «Drugs, affecting function of executive bodies and processes of tissue metabolism», writing student’s medicines formulary |
| | **Раздел 7. Anti-inflammatory, antiallergic, chemotherapeutic and immunotropic drugs** | | | | | | | |
| 7.1 | Anti-inflammatory and antiallergic medicines /Лек/ | 4 | 2 | | Э1 Э2 Э3 | | | |
| 7.2 | Anti-inflammatory and antiallergic medicines /Пр/ | 4 | 2 | | Э1 Э2 Э3 | 1 | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 7.3 | Principles of antimicrobal therapy. Antiseptic and dezinfecting drugs /Лек/ | 4 | 2 | | Э1 Э2 Э3 | | | |
| 7.4 | Principles of antimicrobal therapy. Antiseptic and dezinfecting drugs /Пр/ | 4 | 2 | | Э1 Э2 Э3 | | | |
| 7.5 | Antibiotics (b-lactam antibiotics) /Лек/ | 4 | 2 | | Э1 Э2 Э3 | | | |
| 7.6 | Antibiotics (b-lactam antibiotics) /Пр/ | 4 | 2 | | Э1 Э2 Э3 | | | |
| 7.7 | Antibacterial drugs of different chemical structure /Лек/ | 4 | 2 | | Э1 Э2 Э3 | | | |
| 7.8 | Antibacterial drugs of different chemical structure /Пр/ | 4 | 2 | | Э1 Э2 Э3 | 1 | | |
| 7.9 | Antituberculous drugs /Лек/ | 4 | 2 | | Э1 Э2 Э3 | | | |
| 7.10 | Antituberculous drugs /Пр/ | 4 | 2 | | Э1 Э2 Э3 | 1 | | |
| 7.11 | Antiviral drugs /Лек/ | 4 | 2 | | Э1 Э2 Э3 | | | |
| 7.12 | Antiviral drugs /Пр/ | 4 | 2 | | Э1 Э2 Э3 | 1 | | |
| 7.13 | Anti-spirochetes and antifungal drugs /Пр/ | 4 | 2 | | Э1 Э2 Э3 | 1 | | |
| 7.14 | Anthelmintic drugs /Лек/ | 4 | 2 | | Э1 Э2 Э3 | | | |
| 7.15 | Pharmacology and Evidence medicine /Лек/ | 4 | 2 | | Э1 Э2 Э3 | | | |
| 7.16 | Independent work on the section «Antiinflammatory,antiallergic, chemotherapeutic and immunotropic medicines" /Ср/ | 4 | 21 | | Э1 Э2 Э3 | | | Preparation for the colloquium on section «Antiinflammatory,antiallergic, chemotherapeutic and immunotropic medicines», writing student's medicines formulary |
| 7.17 | Total attestation /КрЭк/ | 4 | 0,5 | | Э1 Э2 Э3 | | | |
| 7.18 | Consultation /Экзамен/ | 4 | 29,5 | | Э1 Э2 Э3 | | | |

## 5. ФОНД ОЦЕНОЧНЫХ СРЕДСТВ

### 5.1. Контрольные вопросы и задания

Section I. General Pharmacology

1. Definition, objectives and branches of pharmacology.
2. Main routes of drug administration.
3. Mechanisms of drug absorption.
4. Drug distribution and plasma protein binding.
5. Drug metabolism: Phase I and Phase II reactions.
6. Renal and non-renal drug excretion.
7. Bioavailability and bioequivalence.
8. Volume of distribution and clearance.
9. Elimination half-life and steady-state concentration.
10. Drug receptors and mechanisms of action.
11. Agonists, partial agonists and antagonists.
12. Dose-response relationships and therapeutic index.
13. Drug tolerance, tachyphylaxis and dependence.
14. Adverse drug reactions and their classification.

15. Pharmacokinetic and pharmacodynamic drug interactions.

Section II. Drugs Acting on the Peripheral Nervous System
16. Cholinergic neurotransmission.
17. Muscarinic receptor agonists and antagonists.
18. Acetylcholinesterase inhibitors.
19. Adrenergic receptors and their functions.
20. Alpha- and beta-adrenoceptor agonists.
21. Alpha- and beta-adrenoceptor antagonists.
22. Local anesthetics: classification and mechanisms.
23. Factors affecting the action of local anesthetics.

Section III. Drugs Acting on the Central Nervous System
24. General anesthetics.
25. Sedative and hypnotic drugs.
26. Benzodiazepines and their pharmacological effects.
27. Antiepileptic drugs.
28. Opioid analgesics.
29. Non-opioid analgesics.
30. Antipsychotic drugs.
31. Antidepressants.
32. Drugs used in Parkinson's disease.

Section IV. Cardiovascular and Renal Pharmacology
33. Antihypertensive drug classification.
34. ACE inhibitors and angiotensin receptor blockers.
35. Beta-blockers and calcium channel blockers.
36. Diuretics: classification and mechanisms.
37. Drugs used in heart failure.
38. Antiarrhythmic drugs.
39. Antianginal drugs.
40. Anticoagulants and antiplatelet agents.
41. Lipid-lowering drugs.

Section V. Anti-inflammatory and Endocrine Pharmacology
42. Nonsteroidal anti-inflammatory drugs.
43. Glucocorticoids.
44. Antihistamines.
45. Insulin preparations.
46. Oral glucose-lowering drugs.
47. Thyroid hormones and antithyroid drugs.
48. Drugs affecting bone metabolism.

Section VI. Antimicrobial Chemotherapy
49. General principles of antimicrobial chemotherapy.
50. Beta-lactam antibiotics.
51. Macrolides.
52. Aminoglycosides.
53. Tetracyclines.
54. Fluoroquinolones.
55. Glycopeptide antibiotics.
56. Antituberculosis drugs.
57. Antifungal drugs.
58. Antiviral drugs.
59. Antimicrobial resistance.
60. Principles of antimicrobial stewardship.

Section VII. Clinical Applications and Drug Safety
61. Principles of rational prescribing.
62. Polypharmacy and potentially inappropriate medication use.
63. Drug use in children.
64. Drug use during pregnancy and lactation.
65. Drug use in older adults.
66. Dose adjustment in renal impairment.
67. Dose adjustment in hepatic impairment.
68. Pharmacovigilance and adverse drug reaction reporting.
69. Drug interactions in patients with multimorbidity.
70. Deprescribing: pharmacological principles and safety considerations.

5. Multiple-Choice Questions (MCQs)
Choose one correct answer.
Sample MCQ assessment — 10 questions
Single best answer
1. Which pharmacokinetic parameter describes the fraction of an administered dose reaching systemic circulation unchanged?
A. Clearance
B. Bioavailability
C. Volume of distribution
D. Half-life
2. Which receptor is primarily responsible for the bronchodilator effect of salbutamol?
A. Alpha-1
B. Beta-1
C. Beta-2
D. Muscarinic M2
3. Which drug class inhibits angiotensin-converting enzyme?
A. Beta-blockers
B. ACE inhibitors
C. Calcium channel blockers
D. Thiazide diuretics
4. Which enzyme is primarily inhibited by aspirin?
A. Acetylcholinesterase
B. Cyclooxygenase
C. Monoamine oxidase
D. Xanthine oxidase
5. Which antibiotic class inhibits bacterial cell wall synthesis?
A. Macrolides
B. Tetracyclines
C. Beta-lactams
D. Aminoglycosides
6. Which laboratory parameter is routinely used to monitor warfarin therapy?
A. Blood glucose
B. INR
C. Serum sodium
D. Hemoglobin A1c
7. Which drug is a loop diuretic?
A. Hydrochlorothiazide
B. Spironolactone
C. Furosemide
D. Amiloride
8. Which receptor is blocked by atropine?
A. Nicotinic receptor
B. Muscarinic receptor
C. Beta-1 receptor
D. Dopamine D2 receptor
9. Which adverse effect is particularly associated with aminoglycosides?
A. Ototoxicity
B. Gingival hyperplasia
C. Dry cough
D. Hypoglycemia
10. Which drug reverses opioid-induced respiratory depression?
A. Flumazenil
B. Naloxone
C. Atropine
D. Protamine
Check answersReset

6. Situational Pharmacological Tasks
Case 1. NSAIDs and Anticoagulants
A 68-year-old patient with atrial fibrillation is receiving warfarin. The patient develops joint pain and asks whether ibuprofen can be taken regularly.
Questions:
1. Explain the pharmacological interaction between warfarin and ibuprofen.
2. Identify the potential adverse effects.
3. Suggest safer pharmacological considerations for pain management.
Expected answer: Increased bleeding risk due to the anticoagulant effect of warfarin and the effects of ibuprofen on gastrointestinal mucosa and platelet function. Alternative analgesia requires individual assessment, and INR monitoring remains important. Warfarin should not be discontinued without medical supervision.

Case 2. ACE Inhibitor–Induced Cough
A patient receiving enalapril develops a persistent dry cough.
Questions:
1. Explain the mechanism of this adverse reaction.
2. Identify the pharmacological class of enalapril.
3. Which alternative drug class may be considered?
Expected answer: ACE inhibition reduces bradykinin degradation. An angiotensin II receptor blocker may be considered when clinically appropriate.
Case 3. Aminoglycoside Toxicity
A patient receiving gentamicin develops impaired hearing and increased serum creatinine.
Questions:
1. Identify the suspected adverse drug reactions.
2. Explain their pharmacological basis.
3. Describe appropriate safety monitoring.
Expected answer: Possible ototoxicity and nephrotoxicity. Renal function, drug exposure and auditory/vestibular symptoms should be assessed; drug-level monitoring is used when indicated.
Case 4. Beta-Blockers and Bronchial Asthma
A patient with bronchial asthma receives propranolol and subsequently develops bronchospasm.
Questions:
1. Explain the mechanism of bronchospasm.
2. Compare nonselective and cardioselective beta-blockers.
3. Identify the pharmacological precautions.
Expected answer: Propranolol blocks beta-2 adrenergic receptors, potentially causing bronchoconstriction. Beta-1-selective agents have less beta-2 blockade but still require careful individual risk assessment.
Case 5. Hypoglycemia During Insulin Therapy
A patient receiving insulin develops sweating, tremor, palpitations and confusion.
Questions:
1. Identify the likely adverse effect.
2. Explain the pharmacological mechanism.
3. Identify the main principles of prevention and immediate management.
Expected answer: Suspected hypoglycemia caused by insulin-mediated glucose lowering. Confirm glucose promptly when feasible and treat according to consciousness, swallowing ability and established hypoglycemia protocols.

7. Drug Dosage Calculation Tasks
All values in these tasks are illustrative educational data, not universal clinical prescribing recommendations.

| No. | Task |
|---|---|
| 1 | Calculate the volume required for a 250 mg dose from a solution containing 100 mg/mL. |
| 2 | Calculate a 12 mg/kg dose for a patient weighing 25 kg. |
| 3 | A tablet contains 500 mg. How many tablets provide 1 g? |
| 4 | Calculate the infusion rate for 500 mL over 4 hours in mL/hour. |
| 5 | Convert 0.75 g into milligrams. |
| 6 | Calculate the volume containing 40 mg from a 2% w/v solution. |
| 7 | Calculate the total daily dose for 250 mg administered three times daily. |
| 8 | A vial contains 1 g in 10 mL after reconstitution. Calculate the volume for 400 mg. |
| 9 | Calculate a 5 mg/kg educational dose for a 60 kg patient. |
| 10 | Convert 125 micrograms into milligrams. |

For final assessment, each calculation task should have a model answer, units, scoring rubric and a safety check where applicable.

8. Prescription-Writing Tasks
Write educational prescriptions using appropriate dosage forms, strengths and standard prescription conventions for the following medicines:
1. Paracetamol tablets.
2. Ibuprofen tablets.
3. Amoxicillin capsules.
4. Omeprazole capsules.
5. Salbutamol metered-dose inhaler.
6. Enalapril tablets.
7. Amlodipine tablets.
8. Metformin tablets.
9. Furosemide tablets.
10. Loratadine tablets.
11. Prednisolone tablets.
12. Doxycycline capsules.
13. Fluconazole capsules.
14. Atorvastatin tablets.
15. Nitroglycerin sublingual tablets.
16. Metoprolol tablets.
17. Spironolactone tablets.

18. Ceftriaxone powder for injection.
19. Lidocaine solution for injection.
20. Insulin preparation.

For each prescription, students must identify the drug's pharmacological group, mechanism of action, major indications, contraindications and clinically important adverse reactions.

9. Examination Questions for Interim Assessment

The final examination should include questions covering all major pharmacological systems, with particular emphasis on mechanisms of action, comparison of pharmacological groups and drug safety.

Suggested examination domains:

General pharmacology - 10
Autonomic nervous system and local anesthetics - 8
Central nervous system - 8
Cardiovascular and renal pharmacology - 10
Endocrine and anti-inflammatory pharmacology - 8
Antimicrobial chemotherapy - 10
Rational drug use and pharmacovigilance - 6
Total - 60

10. Sample Examination Tickets

Examination Ticket No. 1

1. Pharmacokinetics: absorption, distribution, metabolism and excretion.
2. Beta-adrenergic blockers: classification, mechanisms and adverse reactions.
3. Practical task: calculate a drug dose based on body weight.

Examination Ticket No. 2

1. Drug receptors: agonists and antagonists.
2. Beta-lactam antibiotics: mechanisms, classification and resistance.
3. Practical task: analyze an antibiotic-related adverse reaction.

Examination Ticket No. 3

1. Drug bioavailability and elimination half-life.
2. NSAIDs: classification, mechanisms and safety.
3. Practical task: identify a clinically significant drug interaction.

**5.2. Темы курсовых работ (проектов)**

no

**5.3. Фонд оценочных средств**

APPENDIX 1. PHARMACOLOGICAL DRUG STUDY TEMPLATE

1. Purpose

This template is designed to help students systematically study medicinal products, understand their pharmacological properties, mechanisms of action, therapeutic effects, indications, contraindications and adverse reactions.

Students should use this template when studying individual drugs and pharmacological groups during practical classes and independent work.

2. Pharmacological Drug Study Form

1. General information

- International Nonproprietary Name (INN):
- Brand name(s):
- Pharmacological group:
- Chemical class (if applicable):
- Dosage forms:
- Routes of administration:

2. Mechanism of action

- Main molecular or cellular target:
- Mechanism of pharmacological action:
- Effects on organs and systems:
- Relationship between mechanism of action and therapeutic effect:

3. Pharmacodynamics

- Main pharmacological effects:
- Therapeutic effects:
- Additional or secondary effects:
- Dose-response relationship:
- Selectivity of action:

4. Pharmacokinetics (ADME)

- Absorption:
- Bioavailability:
- Distribution:
- Plasma protein binding:
- Metabolism:
- Main metabolic pathways:

- Elimination:
- Half-life (T½):
- Factors affecting pharmacokinetics:

5. Indications
- Main clinical indications:
- Additional indications:
- Clinical situations in which the medicine may be preferred:

6. Contraindications and precautions
- Absolute contraindications:
- Relative contraindications:
- Precautions in patients with comorbidities:
- Use in pregnancy and lactation:
- Use in children and older adults:

7. Adverse drug reactions
- Common adverse reactions:
- Serious adverse reactions:
- Dose-dependent adverse reactions:
- Important organ-specific toxicities:
- Prevention and management of adverse reactions:

8. Drug interactions
- Pharmacodynamic interactions:
- Pharmacokinetic interactions:
- Clinically significant interactions:
- Medicines or substances that should be avoided or used with caution:

9. Dosage and administration
- Usual adult dose (according to approved prescribing information):
- Route of administration:
- Frequency of administration:
- Duration of treatment:
- Dose adjustment in renal impairment:
- Dose adjustment in hepatic impairment:
- Special dosing considerations:

10. Monitoring of treatment
- Parameters for assessing therapeutic efficacy:
- Clinical parameters to be monitored:
- Laboratory parameters:
- Signs of toxicity:
- Criteria for treatment modification or discontinuation:

11. Rational use of the medicine
- Evidence supporting its use:
- Place in current clinical guidelines:
- Important alternatives:
- Cost-effectiveness and availability considerations:
- Key principles of safe prescribing:

12. Student's conclusion

Summarize the main pharmacological characteristics of the medicine and explain the clinical rationale for its use.

3. Student Assessment Checklist

The student should demonstrate the ability to:
- Identify the pharmacological group and mechanism of action.
- Explain the relationship between pharmacodynamics and therapeutic effects.
- Describe the main pharmacokinetic characteristics.
- Identify indications and contraindications.
- Recognize clinically significant adverse reactions.
- Identify important drug interactions.
- Explain principles of dosage selection and adjustment.
- Determine parameters for monitoring efficacy and safety.
- Justify the rational use of the medicine.

APPENDIX 2. SELF-ASSESSMENT QUESTIONS AND PRACTICAL TASKS

1. Purpose

This appendix is intended for students' independent preparation, ongoing assessment and revision of the main topics of Pharmacology. It includes review questions, multiple-choice questions and situational tasks covering general and special pharmacology.

2. Review Questions by Topic

Topic 1. General Pharmacology

1. Define pharmacology and describe its main branches.
2. What is pharmacokinetics?
3. What is pharmacodynamics?

4. Describe the main stages of ADME.
5. Explain the concept of bioavailability.
6. What is the volume of distribution?
7. Define plasma half-life.
8. What is drug clearance?
9. Explain the difference between agonists and antagonists.
10. What is the therapeutic index?
11. Describe the main routes of drug administration.
12. What factors influence drug absorption?
13. Explain first-pass metabolism.
14. What is drug tolerance?
15. What is drug dependence?

Topic 2. Drugs Affecting the Peripheral Nervous System

1. Describe the organization of the autonomic nervous system.
2. What are cholinergic receptors?
3. Classify cholinergic agonists.
4. Describe the pharmacological effects of anticholinesterase agents.
5. What are antimuscarinic drugs?
6. Describe the effects of alpha- and beta-adrenergic receptor stimulation.
7. Classify adrenergic agonists.
8. What are beta-adrenoceptor blockers?
9. Describe the therapeutic uses of alpha-adrenoceptor blockers.
10. Explain the pharmacological effects of neuromuscular blocking agents.

Topic 3. Drugs Affecting the Central Nervous System

1. Classify sedative and hypnotic drugs.
2. Describe the mechanism of action of benzodiazepines.
3. What are the main adverse effects of benzodiazepines?
4. Classify antiepileptic drugs.
5. Describe the mechanisms of action of major antiepileptic drug groups.
6. Classify antipsychotic drugs.
7. What are extrapyramidal adverse effects?
8. Describe the pharmacological effects of antidepressants.
9. Classify opioid analgesics.
10. Explain the mechanism of action of non-opioid analgesics.

Topic 4. Cardiovascular Drugs

1. Classify antihypertensive medicines.
2. Describe the mechanism of action of ACE inhibitors.
3. What are the indications and adverse effects of angiotensin II receptor blockers?
4. Classify calcium channel blockers.
5. Explain the mechanism of action of beta-blockers.
6. Classify antianginal drugs.
7. Describe the main groups of antiarrhythmic drugs.
8. Classify diuretics.
9. Explain the mechanism of action of loop diuretics.
10. Describe the pharmacological effects of statins.
11. What are the main adverse effects of anticoagulants?
12. Compare antiplatelet agents and anticoagulants.

Topic 5. Drugs Affecting the Respiratory and Digestive Systems

1. Classify bronchodilators.
2. Describe the mechanism of action of beta-2 agonists.
3. What is the role of inhaled corticosteroids in asthma?
4. Classify antitussive and mucolytic agents.
5. Classify proton pump inhibitors.
6. Describe the mechanism of action of H2-receptor blockers.
7. What are prokinetic agents?
8. Classify antiemetic drugs.
9. Describe the pharmacological effects of laxatives.
10. What are the main groups of antidiarrheal drugs?

Topic 6. Endocrine Pharmacology

1. Classify insulin preparations.
2. Describe the mechanism of action of insulin.
3. Classify oral glucose-lowering medicines.
4. Explain the mechanism of action of metformin.
5. Describe the pharmacological effects of SGLT2 inhibitors.
6. What are the main adverse effects of sulfonylureas?
7. Classify thyroid hormone preparations and antithyroid drugs.
8. Describe the pharmacological effects of glucocorticosteroids.
9. What are the risks of long-term glucocorticosteroid therapy?

10. Describe the pharmacological effects of sex hormones.

Topic 7. Antimicrobial Pharmacology

1. Classify antibacterial medicines.
2. Describe the mechanisms of action of beta-lactam antibiotics.
3. Compare penicillins and cephalosporins.
4. What are the mechanisms of bacterial resistance?
5. Describe the pharmacological effects of macrolides.
6. What are the main adverse effects of aminoglycosides?
7. Classify fluoroquinolones.
8. What is antimicrobial stewardship?
9. Explain the importance of rational antibiotic selection.
10. What factors determine the duration of antimicrobial therapy?

3. Multiple-Choice Questions

Choose ONE correct answer.

1. Bioavailability refers to:
A. The degree of plasma protein binding
B. The fraction of an administered dose reaching systemic circulation unchanged
C. The rate of renal elimination
D. The duration of drug action
2. Which route of administration avoids gastrointestinal absorption?
A. Oral
B. Sublingual
C. Intravenous
D. Rectal
3. Which receptor is primarily stimulated by salbutamol?
A. Alpha-1 adrenergic receptor
B. Beta-1 adrenergic receptor
C. Beta-2 adrenergic receptor
D. Muscarinic receptor
4. Which medicine is an ACE inhibitor?
A. Enalapril
B. Amlodipine
C. Losartan
D. Bisoprolol
5. Which adverse effect is characteristic of loop diuretics?
A. Hyperkalemia
B. Hypokalemia
C. Hyperglycemia in all patients
D. Severe bradycardia
6. Which drug group inhibits platelet aggregation?
A. Proton pump inhibitors
B. Antiplatelet agents
C. Loop diuretics
D. Antihistamines
7. Which medicine is a proton pump inhibitor?
A. Omeprazole
B. Metoclopramide
C. Famotidine
D. Ondansetron
8. Which adverse reaction is associated with aminoglycosides?
A. Nephrotoxicity
B. Severe hypoglycemia
C. Hyperthyroidism
D. Constipation in all patients
9. Metformin primarily reduces:
A. Hepatic glucose production
B. Insulin secretion
C. Intestinal protein absorption
D. Renal potassium excretion
10. Which medicine is used to reverse the effects of unfractionated heparin?
A. Vitamin K
B. Protamine sulfate
C. Naloxone
D. Atropine
11. Which group of drugs is associated with an increased risk of gastrointestinal bleeding?
A. NSAIDs
B. Antacids

C. Antihistamines
D. Bronchodilators
12. Which parameter is particularly important when monitoring aminoglycoside treatment?
A. Renal function
B. Visual acuity only
C. Thyroid function only
D. Serum calcium only
13. Which medicine is a selective serotonin reuptake inhibitor (SSRI)?
A. Fluoxetine
B. Diazepam
C. Haloperidol
D. Carbamazepine
14. Which drug is an opioid receptor antagonist?
A. Morphine
B. Naloxone
C. Tramadol
D. Fentanyl
15. Which of the following is a major principle of rational pharmacotherapy?
A. Prescribing the maximum number of medicines
B. Selecting treatment based on clinical evidence and patient characteristics
C. Using antibiotics for all febrile conditions
D. Avoiding treatment monitoring

4. Answer Key

| Question | Correct answer |
|---|---|
| 1 | B |
| 2 | C |
| 3 | C |
| 4 | A |
| 5 | B |
| 6 | B |
| 7 | A |
| 8 | A |
| 9 | A |
| 10 | B |
| 11 | A |
| 12 | A |
| 13 | A |
| 14 | B |
| 15 | B |

5. Situational Clinical Tasks
Case 1. Adverse Effects of Antihypertensive Therapy
A 58-year-old patient develops a persistent dry cough after starting enalapril.
Questions:
1. Which pharmacological group does enalapril belong to?
2. Explain the mechanism responsible for the cough.
3. Which alternative pharmacological group may be considered?
4. What parameters should be monitored after changing treatment?
Expected answer: Enalapril is an ACE inhibitor. ACE inhibition reduces bradykinin degradation, which may contribute to a persistent dry cough. An angiotensin II receptor blocker may be considered when clinically appropriate. Blood pressure, renal function and serum potassium should be monitored.
Case 2. Hypoglycemia
A patient with diabetes mellitus develops sweating, tremor, palpitations and confusion after taking insulin without eating.
Questions:
1. What is the most likely adverse reaction?
2. Explain the mechanism.
3. What immediate measures are required?
4. How can similar episodes be prevented?
Expected answer: Insulin-induced hypoglycemia. Insulin increases glucose uptake and reduces blood glucose concentration. Immediate treatment depends on consciousness and ability to swallow; oral fast-acting glucose is appropriate for an alert patient, whereas severe hypoglycemia requires emergency treatment according to protocol. Review insulin timing, dose, meals and glucose monitoring.
Case 3. Antibiotic-Associated Diarrhea
A patient develops diarrhea during a course of broad-spectrum antibiotics.
Questions:
1. What may be the pharmacological cause?
2. Which serious complication should be considered?
3. What clinical information should be assessed?

4. What principles should guide further antibiotic use?

Expected answer: Antibiotic-associated diarrhea due to disruption of normal intestinal microbiota is possible. Clostridioides difficile infection should be considered, especially in significant or persistent diarrhea. Assess severity, hydration, recent antibiotic exposure and other risk factors. Reassess the indication for antibiotics and follow appropriate diagnostic and treatment guidance.

Case 4. NSAID Use

A 65-year-old patient with hypertension and a history of peptic ulcer disease takes ibuprofen for joint pain.

Questions:

1. What pharmacological group does ibuprofen belong to?
2. Explain its mechanism of action.
3. Identify major risks in this patient.
4. What safer prescribing principles should be considered?

Expected answer: Ibuprofen is a non-steroidal anti-inflammatory drug (NSAID) that inhibits cyclooxygenase and reduces prostaglandin synthesis. Potential risks include gastrointestinal bleeding, renal impairment, fluid retention and worsening blood pressure control. Assess the need for an NSAID, contraindications, alternatives and gastroprotection where appropriate.

Case 5. Bronchial Asthma

A patient uses salbutamol frequently to relieve asthma symptoms.

Questions:

1. Which receptor does salbutamol stimulate?
2. What is its principal pharmacological effect?
3. What does frequent use of a reliever inhaler indicate?
4. What should be reviewed in the patient's treatment plan?

Expected answer: Salbutamol is a short-acting beta-2 agonist that produces bronchodilation. Frequent use may indicate inadequate asthma control. Assess symptoms, inhaler technique, adherence, exacerbation risk and the need for an inhaled corticosteroid-containing treatment regimen in accordance with current asthma guidelines.

6. Practical Assessment Tasks

1. Classify the main groups of antihypertensive drugs and provide examples.
2. Explain the mechanism of action of beta-blockers.
3. Compare loop and thiazide diuretics.
4. Describe the pharmacological effects of glucocorticosteroids.
5. Explain the mechanism of action of insulin.
6. Compare oral and parenteral routes of drug administration.
7. Identify the main adverse effects of NSAIDs.
8. Explain the principles of rational antibiotic therapy.
9. Prepare a pharmacological profile of one assigned medicine using Appendix 1.
10. Write a prescription for a medicine using the correct Latin prescription format and an appropriate dosage form.

7. Criteria for Self-Assessment

- Excellent: demonstrates comprehensive knowledge, explains mechanisms of action, applies knowledge to clinical situations and identifies important safety issues.
- Good: demonstrates sound knowledge and can solve standard tasks with minor inaccuracies.
- Satisfactory: demonstrates basic knowledge but has difficulty applying it to clinical situations.
- Unsatisfactory: demonstrates insufficient knowledge and cannot correctly explain the main pharmacological principles or solve basic tasks.

APPENDIX 3. GUIDELINES FOR PRESCRIPTION WRITING AND DRUG DOSAGE CALCULATIONS

1. Purpose

This appendix provides students with basic principles of prescription writing, dosage form selection and drug dose calculations. The aim is to develop practical skills necessary for safe and rational prescribing in clinical practice.

2. General Principles of Prescription Writing

A prescription is a formal instruction from an authorized healthcare professional to dispense and use a medicinal product.

A prescription should be:

- Legible and unambiguous.
- Complete and clinically justified.
- Written using the International Nonproprietary Name (INN), whenever applicable and consistent with local regulations.
- Consistent with approved prescribing information and current clinical guidelines.
- Appropriate for the patient's age, weight, diagnosis, renal and hepatic function, and other relevant characteristics.

3. Main Elements of a Prescription

A traditional prescription may contain the following elements:

1. Inscriptio – information about the healthcare institution or prescriber.
2. Datum – date of issue.
3. Nomen aegroti – patient's name.
4. Aetas aegroti – patient's age.
5. Invocatio (Rp.) – prescription instruction.
6. Praescriptio – name and quantity of the medicinal product.
7. Subscriptio – instructions to the pharmacist.
8. Signatura (S.) – instructions for the patient.
9. Nomen medici – prescriber's name and signature.

The exact format and legal requirements must follow the applicable national regulations and institutional procedures.

4. Common Dosage Forms

| Dosage form | Latin term | Example |
|---|---|---|
| Tablet | Tabuletta | Tabulettae |
| Capsule | Capsula | Capsulae |
| Solution | Solutio | Solutionis |
| Suspension | Suspensio | Suspensionis |
| Ointment | Unguentum | Unguenti |
| Cream | Cremor | Cremoris |
| Suppository | Suppositorium | Suppositoria |
| Drops | Guttae | Guttarum |
| Powder | Pulvis | Pulveris |

5. Examples of Prescription Writing

The following examples are educational exercises. They must not be interpreted as recommendations for individual patients.

Example 1. Tablets

Rp.: Tabulettas Paracetamoli 0.5 № 10

D.S. Take one tablet orally as directed.

Example 2. Capsules

Rp.: Capsulas Amoxicillini 0.5 № 20

D.S. Use according to the prescribed treatment regimen.

Example 3. Oral Solution

Rp.: Solutionis Paracetamoli 120 mg/5 ml — 100 ml

D.S. Administer orally according to the prescribed dose.

Example 4. Ointment

Rp.: Unguenti Hydrocortisoni 1% — 10.0

D.S. Apply externally as directed.

Note: Prescription format, Latin nomenclature, quantities and dispensing requirements should be adapted to the current regulations of the Kyrgyz Republic. These examples are intended for teaching prescription structure, not for actual dispensing.

6. General Rules for Drug Dosage Calculations

Students should be able to calculate:

- A single dose.
- A daily dose.
- The total amount of medicine required for a course of treatment.
- The volume of liquid medicine corresponding to a prescribed dose.
- Weight-based doses (mg/kg).
- Infusion rates.
- Dose adjustments where clinically indicated.

6.1. Calculation of the Daily Dose

Formula:

Daily dose = Single dose × Number of administrations per day

Example:

A medicine is prescribed at 250 mg three times daily.

Daily dose = 250 mg × 3 = 750 mg/day.

6.2. Calculation of the Total Course Dose

Formula:

Total course dose = Daily dose × Number of treatment days

Example:

A medicine is prescribed at 500 mg twice daily for 5 days.

Daily dose = 500 × 2 = 1,000 mg/day.

Total course dose = 1,000 × 5 = 5,000 mg.

6.3. Weight-Based Dose Calculation

Formula:

Prescribed dose = Recommended dose (mg/kg) × Body weight (kg)

Example:

A hypothetical medicine has a recommended educational dose of 10 mg/kg for a patient weighing 20 kg.

Dose = 10 × 20 = 200 mg.

The actual dose must be checked against the medicine's maximum recommended dose, age-specific guidance, indication and patient-specific factors.

6.4. Calculation of Liquid Medicine Volume

Formula:

Volume (ml) = Required dose (mg) ÷ Concentration (mg/ml)

Example:

Required dose: 150 mg.

Medicine concentration: 50 mg/ml.

Volume = 150 ÷ 50 = 3 ml.

6.5. Calculation of Infusion Rate
Formula:
Infusion rate (ml/hour) = Total volume (ml) ÷ Infusion time (hours)
Example:
A solution of 500 ml is administered over 4 hours.
Infusion rate = 500 ÷ 4 = 125 ml/hour.
For gravity infusion, the drop rate is calculated using the specific infusion set's drop factor:
Drops/minute = Volume (ml) × Drop factor (drops/ml) ÷ Time (minutes).

7. Special Considerations in Dosage Selection
7.1. Pediatric Patients
- Calculate doses according to the child's body weight or body surface area when required.
- Check the maximum single and daily doses.
- Consider age-related differences in absorption, distribution, metabolism and elimination.
- Use age-appropriate dosage forms.
- Verify the concentration of liquid preparations carefully.

7.2. Older Adults
- Consider age-related changes in renal and hepatic function.
- Assess polypharmacy and potential drug interactions.
- Start with an appropriate dose and titrate according to clinical response where indicated.
- Monitor adverse reactions and treatment effectiveness.

7.3. Renal Impairment
- Assess renal function using an appropriate method for the medicine and clinical situation.
- Identify medicines requiring dose or interval adjustment.
- Consider accumulation and toxicity.
- Follow the approved prescribing information and relevant clinical guidelines.

7.4. Hepatic Impairment
- Consider the role of hepatic metabolism in drug elimination.
- Assess the risk of accumulation and toxicity.
- Review medicines with significant hepatic metabolism or hepatotoxic potential.
- Use specific dose-adjustment recommendations where available.

8. Practical Tasks for Students
Task 1. Daily Dose
A medicine is prescribed at 100 mg three times daily. Calculate the total daily dose.
Answer: 300 mg/day.
Task 2. Course Dose
A medicine is prescribed at 250 mg twice daily for 7 days. Calculate the total amount required for the course.
Answer: 3,500 mg (3.5 g).
Task 3. Weight-Based Dose
A hypothetical medicine is prescribed at 5 mg/kg for a patient weighing 30 kg. Calculate the dose.
Answer: 150 mg.
Task 4. Liquid Preparation
The required dose is 200 mg. The solution contains 100 mg in 5 ml. Calculate the volume.
Answer: 10 ml.
Task 5. Infusion Rate
A 1,000 ml infusion is administered over 8 hours. Calculate the infusion rate.
Answer: 125 ml/hour.
Task 6. Number of Tablets
A patient is prescribed 500 mg of a medicine. Each tablet contains 250 mg. How many tablets correspond to one dose?
Answer: 2 tablets.
Task 7. Total Daily Dose
A medicine is prescribed at 75 mg four times daily. Calculate the daily dose.
Answer: 300 mg/day.
Task 8. Infusion Drop Rate
A 500 ml infusion is administered over 5 hours using an infusion set with a drop factor of 20 drops/ml. Calculate the approximate drop rate.
Answer: 33 drops/minute (rounded).

9. Practical Skills Checklist
The student should be able to:
1. Identify the INN and dosage form.
2. Select an appropriate route of administration.
3. Write a prescription using the required format.
4. Indicate the dose, frequency and duration of administration.
5. Calculate single and daily doses.
6. Calculate total course quantities.
7. Calculate doses according to body weight.

8. Calculate the volume of liquid preparations.
9. Calculate infusion rates.
10. Identify situations requiring dose adjustment.
11. Recognize common prescribing and calculation errors.
12. Verify the safety and appropriateness of a prescribed regimen.

10. Common Errors in Prescription Writing and Dose Calculations
- Confusion between milligrams (mg), micrograms (mcg) and grams (g).
- Incorrect conversion between mg and ml.
- Failure to check the concentration of liquid preparations.
- Confusion between single and daily doses.
- Failure to calculate the total course quantity.
- Incorrect frequency or route of administration.
- Failure to consider maximum recommended doses.
- Failure to account for renal or hepatic impairment.
- Use of ambiguous abbreviations.
- Incomplete or unclear patient instructions.

11. Safety Requirements
All dosage calculations must be checked before a medicine is prescribed or administered. Students must verify the medicine, formulation, concentration, dose, route, frequency and duration.
For high-alert medicines, including insulin, anticoagulants, opioids and concentrated electrolytes, additional independent verification should be performed in accordance with institutional policy.
Important: Educational calculations do not replace clinical judgment. Actual prescribing must comply with current national regulations, approved prescribing information, clinical guidelines and patient-specific requirements.

**5.4. Перечень видов оценочных средств**

Test work on the section "General Recipe"
Colloquium in the section "General Recipe: General Pharmacology"
Control work under the section "Drugs affecting the peripheral neural system"
Control work under the section " Drugs affecting the central neural system"
Colloquium on the topic " Drugs affecting the peripheral and central neural system"
Control work on the section " Drugs affecting the cardiovascular system"
Colloquium in the section " Drugs s that affect the function of executive organs and processes of tissue metabolism"
Control work under the section "Antibiotics, antiseptic and disinfectants"
Colloquium on "Anti-inflammatory, antiallergic, chemotherapeutic and immunotropic
drugs "

## 6. УЧЕБНО-МЕТОДИЧЕСКОЕ И ИНФОРМАЦИОННОЕ ОБЕСПЕЧЕНИЕ ДИСЦИПЛИНЫ (МОДУЛЯ)

**6.1. Рекомендуемая литература**

**6.2. Перечень ресурсов информационно-телекоммуникационной сети "Интернет"**

| | | |
|---|---|---|
| Э1 | | www.medscape.com |
| Э2 | | www.drugs.com |
| Э3 | | www.fda.org |

**6.3. Перечень информационных и образовательных технологий**

**6.3.1 Компетентностно-ориентированные образовательные технологии**

| | |
|---|---|
| 6.3.1.1 | Competence-based Educational Technologies |
| 6.3.1.2 | traditional verbal methods (lectures, talks, explanations); |
| 6.3.1.3 | visual methods (presentations, stands, posters, types of dosage forms, reference books, textbooks, teaching aids, |
| 6.3.1.4 | methods of practical training - conducting active and interactive practical classes: solution situational tasks, tests; |
| 6.3.1.5 | self-study procedures - implementation of the IIW (individual independent work with directories and literature (regular and electronic), independent written homework; |
| 6.3.1.6 | Oral control methods: front-line interview, individual survey, preparation of reports on the IIW; |
| 6.3.1.7 | methods of written control: control and modular work; execution of written test tasks for independent work of the student; |
| 6.3.1.8 | abstracts on the IIW; |
| 6.3.1.9 | methods of monitoring: control and modular work; preparation of the student's formulary for medicines, |
| 6.3.1.10 | assignments for the medical prescription; |
| 6.3.1.11 | innovative methods (discussions, analysis of situational tasks, training conferences on problem areas); |
| 6.3.1.12 | research procedures (research work according to the subject of the department, according to the results of which students |

| 6.3.2 Перечень информационных справочных систем и программного обеспечения | |
|---|---|
| 6.3.2.1 | https://pubmed.ncbi.nlm.nih.gov/ |
| 6.3.2.2 | www.who.int |
| 6.3.2.3 | www.drugs.com |
| 6.3.2.4 | www.medscape.com |

| 7. МАТЕРИАЛЬНО-ТЕХНИЧЕСКОЕ ОБЕСПЕЧЕНИЕ ДИСЦИПЛИНЫ (МОДУЛЯ) | |
|---|---|
| 7.1 | The teaching of Pharmacology is supported by the necessary material, technical, educational, and methodological resources to ensure effective delivery of lectures, practical classes, laboratory sessions, and independent student work. |
| 7.2 | The educational process is provided with: |
| 7.3 | 1. Classrooms and lecture facilities: equipped with multimedia projectors, computers, interactive whiteboards, screens, and audio-visual equipment. |
| 7.4 | 2. Laboratory facilities: equipped with laboratory instruments, pharmacological models, measuring devices, and materials for conducting practical and laboratory sessions. |
| 7.5 | 3. Educational and demonstration materials: pharmacological charts, anatomical models, diagrams of mechanisms of drug action, classification tables, and visual teaching aids. |
| 7.6 | 4. Computer-based learning resources: computers with Internet access, electronic educational platforms, digital presentations, interactive learning materials, and online databases. |
| 7.7 | 5. Educational literature: textbooks, reference books, manuals, clinical guidelines, and scientific publications in pharmacology and clinical pharmacology, including English-language resources. |
| 7.8 | 6. Pharmaceutical reference resources: access to electronic databases containing information on medicinal products, their pharmacological properties, indications, contraindications, adverse reactions, and drug interactions. |
| 7.9 | 7. Assessment resources: test materials, situational clinical cases, practical assignments, and materials for assessing students' theoretical knowledge and practical competencies. |
| 7.10 | The available material and technical resources facilitate the implementation of modern teaching methods, the development of students' clinical and analytical thinking, and the acquisition of competencies in the rational and safe use of medicines. |

## 8. МЕТОДИЧЕСКИЕ УКАЗАНИЯ ДЛЯ ОБУЧАЮЩИХСЯ ПО ОСВОЕНИЮ ДИСЦИПЛИНЫ (МОДУЛЯ)

1. GENERAL PROVISIONS

Pharmacology is a fundamental medical discipline that studies the interaction between drugs and living organisms, including the mechanisms of drug action, pharmacological effects, therapeutic applications, adverse reactions and principles of rational medicine use. The discipline provides the theoretical and practical foundation necessary for understanding pharmacotherapy in clinical medicine. Knowledge of pharmacology is essential for future physicians in the prevention, treatment and management of diseases.

These methodological guidelines are intended to help students organize independent learning, prepare for practical classes, master theoretical material and develop the skills necessary for the safe and rational use of medicines.

Students are expected to study the discipline systematically, actively participate in practical classes, complete individual assignments and demonstrate the ability to apply pharmacological knowledge to educational clinical situations.

2. AIM AND OBJECTIVES OF STUDYING THE DISCIPLINE

2.1. Aim

The aim of studying Pharmacology is to develop students' knowledge of the principles of drug action, pharmacokinetics, pharmacodynamics, classification of medicines, therapeutic effects, adverse reactions and drug interactions, as well as to develop basic skills in rational and safe use of medicines.

2.2. Objectives

The main objectives are:

To study the general principles of pharmacology.

To understand the mechanisms of drug action and pharmacological effects.

To study pharmacokinetics and pharmacodynamics.

To master the classification of major groups of medicines.

To understand the indications, contraindications and adverse reactions of drugs.

To identify clinically significant drug interactions.

To develop skills in prescription writing.

To perform basic drug dosage calculations.

To understand the principles of rational pharmacotherapy.

To develop an understanding of pharmacological safety and pharmacovigilance.

3. ORGANIZATION OF THE EDUCATIONAL PROCESS

The study of Pharmacology includes the following forms of educational activity:

Lectures;

Practical classes;

Laboratory and demonstration activities, where provided by the curriculum;

Independent student work;

Individual assignments;
Ongoing assessment;
Interim assessment.
Students should attend classes regularly and complete the assigned learning activities within the established deadlines.

The study of each topic should include three interconnected stages:
Stage 1 – Theoretical preparation: studying the lecture material, recommended textbooks and supplementary resources.
Stage 2 – Practical application: solving pharmacological problems, comparing medicines, performing dose calculations and writing prescriptions.
Stage 3 – Assessment and self-evaluation: answering review questions, completing tests and analyzing situational tasks.

4. METHODS OF STUDYING THEORETICAL MATERIAL
When studying each topic, students are advised to follow a structured approach.
4.1. Study of the pharmacological group
For each group of medicines, students should identify:
Definition and classification.
Main representatives of the group.
Mechanism of action.
Pharmacological effects.
Pharmacokinetic characteristics.
Therapeutic indications.
Contraindications and precautions.
Adverse drug reactions.
Clinically significant drug interactions.
Important aspects of safe use.

4.2. Recommended method of studying individual medicines
When studying a specific medicine, students should prepare a short pharmacological profile containing:
International Nonproprietary Name (INN);
Pharmacological group;
Mechanism of action;
Main pharmacological effects;
Pharmacokinetic characteristics;
Indications;
Contraindications;
Adverse reactions;
Drug interactions;
Dosage forms and routes of administration.
Students should focus on understanding the relationship between the mechanism of action, pharmacological effects and therapeutic applications rather than memorizing isolated facts.

5. STUDY OF GENERAL PHARMACOLOGY
General Pharmacology is the foundation for understanding all other sections of the discipline.
Particular attention should be paid to the following topics:
5.1. Pharmacokinetics
Students should understand:
Absorption of medicines;
Distribution of drugs in the body;
Plasma protein binding;
Drug metabolism;
Drug excretion;
Bioavailability;
Volume of distribution;
Clearance;
Elimination half-life;
Steady-state concentration.
Students should be able to explain how changes in renal and hepatic function may influence drug exposure.

5.2. Pharmacodynamics
Students should study:
Drug receptors and receptor interactions;
Agonists and antagonists;
Partial agonists;
Dose-response relationships;
Therapeutic and toxic effects;
Therapeutic index;
Tolerance and tachyphylaxis;
Mechanisms of drug action.

Students should be able to explain the relationship between drug concentration, receptor interaction and pharmacological response.

5.3. Adverse drug reactions and drug interactions
Students should understand the classification of adverse drug reactions, mechanisms of drug interactions and factors contributing to medication-related risks.
Special attention should be given to:
Pharmacokinetic interactions;
Pharmacodynamic interactions;
Allergic reactions;
Toxic reactions;
Drug-induced organ damage;
Medication errors;
Prevention and reporting of adverse drug reactions.

6. STUDY OF SPECIAL PHARMACOLOGY
When studying individual groups of medicines, students should use a systematic approach.
6.1. Drugs acting on the nervous system
Students should study the pharmacological effects and mechanisms of medicines acting on:
Cholinergic neurotransmission;
Adrenergic neurotransmission;
Central nervous system;
Peripheral nervous system.
Particular attention should be paid to local anesthetics, analgesics, sedatives, hypnotics, antiepileptic drugs and psychotropic medicines.

6.2. Cardiovascular and renal pharmacology
Students should study:
Antihypertensive medicines;
Antianginal medicines;
Antiarrhythmic drugs;
Drugs used in heart failure;
Diuretics;
Anticoagulants;
Antiplatelet agents;
Lipid-lowering medicines.
Students should understand the mechanisms of action, main pharmacological effects, contraindications and important adverse reactions of these groups.

6.3. Anti-inflammatory and endocrine pharmacology
Students should study:
Nonsteroidal anti-inflammatory drugs (NSAIDs);
Glucocorticoids;
Antihistamines;
Insulin preparations;
Oral antidiabetic medicines;
Thyroid hormones;
Antithyroid medicines.

6.4. Antimicrobial chemotherapy
Students should master the classification and mechanisms of action of:
Beta-lactam antibiotics;
Macrolides;
Aminoglycosides;
Tetracyclines;
Fluoroquinolones;
Glycopeptides;
Antituberculosis medicines;
Antifungal drugs;
Antiviral drugs.
Students should understand antimicrobial resistance, appropriate indications for antimicrobial therapy and the principles of antimicrobial stewardship.

7. METHODOLOGICAL GUIDELINES FOR PRACTICAL CLASSES
Before each practical class, students should:
Read the relevant lecture material.
Study the recommended textbook chapter.
Review the classification of the pharmacological group.
Learn the mechanisms of action of the main medicines.
Prepare answers to the review questions.

Complete assigned test questions.
Prepare for pharmacological problem-solving activities.
During practical classes, students should actively participate in discussions, analyze pharmacological situations, compare medicines and complete practical assignments.
The following teaching methods may be used:
Question-and-answer sessions;
Small-group discussions;
Pharmacological case analysis;
Comparative drug tables;
Prescription-writing exercises;
Dose calculation exercises;
Multiple-choice testing;
Problem-based learning.

8. PRESCRIPTION WRITING
Prescription writing is an important practical component of Pharmacology.
Students should learn the basic principles of writing prescriptions using internationally accepted terminology and the applicable national requirements.
A prescription should include:
Name of the medicine (preferably INN).
Dosage form.
Strength or concentration.
Dose.
Route of administration.
Frequency of administration.
Duration of treatment, where applicable.
Relevant instructions for the patient.
Students should be able to distinguish between tablets, capsules, solutions, suspensions, injections, ointments, creams and other dosage forms.
Prescription exercises are educational activities. Actual prescribing must comply with current clinical guidelines, official product information and national regulations.

9. METHODOLOGICAL GUIDELINES FOR DOSE CALCULATIONS
Students should develop the ability to perform basic pharmaceutical and pharmacological calculations.
The main calculation topics include:
Conversion of measurement units;
Calculation of a single dose;
Calculation of a daily dose;
Calculation of a total treatment-course dose;
Calculation of drug concentration;
Calculation of the volume of a solution;
Calculation of infusion rates;
Weight-based dose calculations.

Examples
Example 1. Conversion of units
Convert 0.5 g into milligrams.
Solution:
$0.5 \times 1000 = 500$ mg.

Example 2. Calculation of a weight-based dose
An educational exercise specifies a dose of 10 mg/kg for a patient weighing 20 kg.
Solution:
$10 \times 20 = 200$ mg.

Example 3. Calculation of solution volume
A solution contains 50 mg of active substance per 1 mL. Calculate the volume containing 100 mg.
Solution:
$100 \div 50 = 2$ mL.
Students must always include the units of measurement and show the calculation steps.
The numerical examples are intended for educational purposes only and must not be interpreted as universal clinical dosing recommendations.

10. INDEPENDENT STUDENT WORK
Independent work is an essential component of mastering Pharmacology.
It may include:
Studying recommended textbook chapters.
Preparing pharmacological group summaries.

Creating comparative tables of medicines.
Preparing drug profiles.
Solving pharmacological situational tasks.
Completing dose calculation exercises.
Writing educational prescriptions.
Preparing presentations and reports.
Reviewing scientific publications.
Preparing for ongoing and interim assessment.
Recommended formats of independent assignments

Assignment 1. Comparative drug table
Students compare two or more medicines from the same pharmacological group according to their mechanisms of action, pharmacological effects, indications, contraindications and adverse reactions.
Assignment 2. Pharmacological drug profile
Students prepare a structured profile of a selected medicine using official prescribing information and recommended textbooks.
Assignment 3. Situational task
Students analyze an educational clinical scenario, identify the relevant pharmacological principles and explain potential drug-related risks.
Assignment 4. Scientific literature review
Students select a recent scientific publication related to pharmacology and prepare a short summary of its objectives, methods, main findings and practical relevance.

11. USE OF INFORMATION RESOURCES
Students are encouraged to use reliable educational and scientific resources.
Recommended resources include:
Katzung's Basic and Clinical Pharmacology;
Rang & Dale's Pharmacology;
Lippincott Illustrated Reviews: Pharmacology;
Goodman & Gilman's The Pharmacological Basis of Therapeutics;
PubMed;
NCBI Bookshelf;
World Health Organization (WHO);
European Medicines Agency (EMA);
Official prescribing information and medicine databases.
When using online resources, students should pay attention to the publication date, reliability of the source and relevance of the information.
Scientific publications should not be replaced by unverified internet sources or commercial promotional materials.

12. PREPARATION FOR ONGOING ASSESSMENT
Ongoing assessment is conducted throughout the semester and may include:
Oral questioning;
Written tests;
Multiple-choice questions;
Practical assignments;
Prescription-writing exercises;
Dose calculation tasks;
Situational pharmacological problems;
Independent work assessment.
To prepare effectively, students should regularly review previously studied topics and complete assignments on time.
It is recommended that students maintain a personal pharmacology notebook containing classifications, mechanisms of action, important drug characteristics and calculation examples.

13. PREPARATION FOR INTERIM ASSESSMENT
Preparation for interim assessment should be systematic and comprehensive.
Students should:
Review all lecture materials.
Study the main pharmacological groups.
Revise mechanisms of action and pharmacological effects.
Review indications, contraindications and adverse reactions.
Practice prescription writing.
Complete dose calculation exercises.
Solve situational pharmacological tasks.
Review the recommended examination questions.
Students should pay particular attention to the ability to explain pharmacological mechanisms and apply theoretical knowledge to educational clinical situations.

14. CRITERIA FOR SUCCESSFUL MASTERING OF THE DISCIPLINE
A student is considered to have successfully mastered the discipline when they can:

Explain the fundamental principles of pharmacokinetics and pharmacodynamics;
Classify major groups of medicines;
Describe mechanisms of action and pharmacological effects;
Identify indications and contraindications;
Recognize common and clinically significant adverse drug reactions;
Explain important drug interactions;
Perform basic dose calculations;
Write educational prescriptions correctly;
Apply principles of rational and safe medicine use;
Analyze pharmacological problems using scientific evidence.

15. RECOMMENDED STUDY STRATEGY
For effective learning, students are advised to follow a regular study schedule.
Before lectures: review the topic and familiarize yourself with basic terminology.
After lectures: summarize the main concepts and revise the pharmacological classifications.
Before practical classes: study the mechanisms of action, drug profiles and review questions.
During independent study: solve calculation exercises, complete situational tasks and prepare comparative tables.
Before examinations: revise the entire course, practice test questions and review the most important mechanisms and adverse reactions.

16. FINAL RECOMMENDATIONS
Pharmacology requires consistent theoretical preparation and regular practical training. Students should focus on understanding the mechanisms of drug action and the relationship between pharmacological effects, therapeutic applications and potential risks.
The ability to use medicines rationally and safely is an essential professional competence of every future physician.
The successful study of Pharmacology provides the foundation for further learning in Clinical Pharmacology, Internal Medicine, Surgery, Pediatrics, Infectious Diseases and other clinical disciplines.