UAB
Universitat Autònoma de Barcelona

Pharmacology

Code: 100943
Credits: 6

2026/2027

Degree programme	Type	Course
Biotechnology	OP	4

Contact lecturer

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Group languages

You can consult this information at the end of the document.

Prerequisites

It is necessary to have obtained sufficient knowledge of Physiology, Biochemistry and Cell Biology.

Objectives

The subject is programmed in the fourth year of the Degree in Biology, when knowledge of Biology, Physiology, and Cell Biology have already been obtained.

The training objectives of the subject are to show the scientific bases on which the medications are based in their preclinical phase by studying the different processes to which a medication is subjected since it is administered until it has its effect, as well as the possible undesired effects and pharmacological interactions that may occur with the administration of drugs. In addition, the pharmacological characteristics of the main groups of drugs are studied.

Learning outcomes

- CM35 (Evaluate the different methodologies useful for obtaining disease models.) Evaluate the different methodologies useful for obtaining disease models.
- CM36 (Assess sex/gender inequalities in molecular pathology, as well as in gene therapy and in the use of vaccines and drugs.) Assess sex/gender inequalities in molecular pathology, as well as in gene therapy and in the use of vaccines and drugs.
- CM37 (Apply the basic principles that regulate the interaction of drugs with organisms.) Apply the basic principles that regulate the interaction of drugs with organisms.

- KM37 (Describe the basic concepts in the treatment of diseases.) Describe the basic concepts in the treatment of diseases.
- KM38 (Detail the molecular bases of diseases and their various mechanisms.) Detail the molecular bases of diseases and their various mechanisms.
- KM39 (Recognize the molecular elements involved in pathogenesis.) Recognize the molecular elements involved in pathogenesis.
- SM35 (Evaluate different molecular models or organisms for disease research.) Evaluate different molecular models or organisms for disease research.
- SM37 (Examine the steps required for the development of a drug or vaccine.) Examine the steps required for the development of a drug or vaccine.

Contents

I. GENERALITIES

Unit 1. Introduction to Pharmacology. Concept of Pharmacology. Parts of Pharmacology. Its relationship with other biological disciplines.

Unit 2. Transport and absorption of drugs through the membranes. General cycle of drugs in the body. Physicochemical characteristics of drugs and their behavior in aqueous solutions. Main mechanisms of transport through the membranes: passive diffusion, facilitated diffusion, active transport, endocytosis and exocytosis. Management channels: Typical and systemic. Concept of Bioavailability. Factors that influence the absorption of drugs.

Unit 3. Distribution of drugs in the body. Factors that influence the distribution of drugs in the body. Union to plasma proteins. Storage of drugs in tissues and organs. Natural barriers: haematoencephalic and placental. Concept of volume of distribution.

Unit 4. Biotransformation of drugs. Structural modification of drugs in the body. Places of metabolic transformation of drugs. Enzymatic mediators in biotransformation. Concept of liver cleansing. Synthetic and non-synthetic metabolic pathways. Modifications in the metabolism of drugs: pharmacological, dependent on sex, age, species and diet.

Unit 5. Drug excretion. Physiology of renal function. Renal drug excretion: glomerular filtration, reabsorption and tubular secretion.Pharmacological modifications of renal excretion processes. Concept of renal depuration. Biliary excretion. Other routes of excretion: pulmonary, mammary, saliva and sweat.

Unit 6. Pharmacokinetics. General concepts. Pharmacokinetic parameters: absorption, distribution and elimination kinetics. Half-life concept, volume of distribution and depuration. Calculation of the pharmacokinetic parameters.

Unit 7. General principles of the mechanism of action of drugs (I). Concept of Pharmacodynamics. Concept of action and effect. Levels of action of the drugs: systemic, tissue, cellular and molecular. Relation-response relationship and parameters that characterize this relationship. Properties inherent to the drug: affinity and efficacy.

Unit 8. General principles of the mechanism of action of drugs (II). Definition of receptor. Analysis of the drug-receptor interaction: binding to receptors and concentration-effect curves. Quantitative aspects of the drug-receptor interaction. Concepts of total, partial and inverse agonist and antagonist. Type of receptors. Receptors coupled to channels. Protein G-coupled receptors. Non receptor-mediated pharmacological actions: ion channels, enzymes, carriers. Other pharmacological targets.

Unit 9. Pharmacological interactions. Concept. Pharmacokinetic interactions. Pharmacodynamic interactions. Concept of synergy and antagonism. Importance of pharmacological interactions.

Unit 10. Undesirable effects. General concepts and terminology. Classification according to its origin: type A, B, C, D and E reactions. Concept of therapeutic risk.

II. PHARMACOLOGY OF CHEMICAL MEDIATORS: PERIPHERAL NERVOUS SYSTEM

Unit 11. Pharmacology of cholinergic transmission. Colinoceptors and their classification. Muscarinic agonists: concept, mechanism of action and classification. Direct agonists: cholina esters, natural and synthetic alkaloids. Indirect agonists: reversible and irreversible cholinesterase inhibitors. Colinoceptors antagonists: antimuscarinics and neuromuscular blockers.

Unit 12. Pharmacology of adrenergic transmission. Concept of adrenoceptor and its classification. Agonists and antagonists of the different adrenoceptors: concept, mechanism of action and classification. Modulators of noradrenergic transmission: inhibitors of the synthesis, storage and release of norepinephrine; drugs favoring the liberation; blockers of neuronal collection mechanisms.

III. PHARMACOLOGY OF CHEMICAL MEDIATORS: CENTRAL NERVOUS SYSTEM

Unit 13. Pharmacology of the noradrenergic and serotoninergic system. Characteristics and functions of the noradrenergic and serotonergic neurotransmission. Neurochemical bases of depression: antidepressant drugs.

Unit 14.Pharmacology of the GABAergic system. Neurotransmission and benzodiazepine receptors. Classification of anxiolytic and hypnotic drugs: benzodiazepines, 5-HT1A agonists and barbiturates.

Unit 15. Pharmacology of the cholinergic system. Characteristics and functions of cholinergic neurotransmission. Alzheimer's disease: anticholinesterase drugs, muscarinic agonists and nicotinic agonists.

Unit 16. Pharmacology of the dopaminergic system. Characteristics, functions and alterations of dopaminergic neurotransmission. Parkinson's disease: levodopa, MAOB inhibitors, dopamine agonists and muscarinic antagonists. Schizophrenia: antipsychotic drugs (phenothiazines, thioxanthens, butyrophenones) and other chemical groups.

Unit 17. Pharmacology of other central mediators: opioid peptides. The opioid system: opioid receptors and endogenous opioid peptides. Concept of analgesic opioid. Total agonists, agonists-antagonists and pure antagonists. Mechanism of action. Pharmacological effects and undesired effects.

IV. PHARMACOLOGY OF CHEMICAL MEDIATORS: ANTIINFLAMATORIES AND IMMUNODEPRESSORS

Unit 18. Immune response and immunomodulators. Cells and molecules of immune response. Pharmacological targets for immunomodulation. Immunosuppressant drugs. Immunoenhancing drugs.

Unit 19. Inflammation and NSAIDs. Concept of inflammation: inflammatory mediators. Non-steroidal anti-inflammatory drugs (NSAIDs). Mechanism of action and undesirable effects. NSAID Groups.

Unit 20. Glucocorticoids and other anti-inflammatory drugs. Glucocorticoids as anti-inflammatories. Antihistaminic drugs. Other medications with an anti-inflammatory effect (antagonists of leukotriene receptors, blocking of PAF, modulation of proinflammatory cytokine activity).

V. ENDOCRINOLOGICAL PHARMACOLOGY

Unit 21. General principles of endocrine pharmacology. Introduction. Mechanisms of hormonal action. Regulation of hormonal secretion. Chemical classification of hormones. Hormone therapy: pharmacokinetic

characteristics, specificity and types of treatments. Present and future of treatments with hormones: insulin.

VI. PHARMACOLOGY OF ORGANS AND SYSTEMS

Unit 22. Cardiovascular pharmacology. Physiopathological bases of heart failure, angina pectoris and cardiac arrhythmias. Cardiotonic, antianginal, vasodilators and anti-arrhythmic drugs.

Unit 23. Diuretics. Concept of diuresis. Anatomy and physiology of the kidney. Place of action for diuretics. Classification. Henle loop diuretics. Benzothiadiazides. Potassium savers. Osmotic diuretics. Other diuretics.

Unit 24. General pharmacology of the digestive tract. Neuropharmacologic mechanisms of vomit. Pharmacological modulation of gastric secretion: antisecretors, protectors and antacids. Pharmacology of motility and intestinal secretion: laxatives and antidiarrheal.

VII. ANTIINFECTIVE PHARMACOLOGY

Unit 25. General principles of anti-infective pharmacology (I). General concepts and terminology: antibiotic, chemotherapic, anti-infection. Mechanisms of action: interference with nucleic acids, protein synthesis, cell membrane, bacterial wall synthesis. Resistance to antibiotics as the main mechanism of therapeutic limitation.

Unit 26. General principles of anti-infective pharmacology (II). Classification of anti-infective drugs: antibacterial, antifungal, antivirals and antiprotozoal drugs. General characteristics of antibacterial drugs. General aspects of antiviral medications. Modern trends in the search for new antibiotics.

VIII. ANTINEOPLASTIC CHEMOTHERAPY

Unit 27. Antineoplastic chemotherapy. Objectives of antineoplastic chemotherapy. Mechanisms of action and adverse reactions to cytotoxic drugs. Tumor sensitivity to cytotoxic drugs. Pharmacological groups.

IX. MISCELLANEOUS

Unit 28. Biotechnological medicines. Biological drugs versus biotechnology. In biotechnology, the process is the product. Pharmacological profile of biotechnological drugs: concept of immunogenicity. Similar biological medication or biosimilar: an EMA regulatory concept. Biosimilar versus generic.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Problem solving	14	0.56	CM35, CM36, CM37, KM37, KM38, KM39, SM35, SM37
Practical computer lessons	2	0.08	CM35, CM36, CM37, KM37, KM38, KM39, SM35, SM37
Problem Based learning sessions	12	0.48	CM35, CM36, CM37, KM37, KM38, KM39, SM35, SM37

Theoretical lessons	26	1.04	CM35, CM36, CM37, KM37, KM38, KM39, SM35, SM37
Laboratory practices	8	0.32	CM35, CM36, CM37, KM37, KM38, KM39, SM35, SM37
Study	70	2.8	CM35, CM36, CM37, KM37, KM38, KM39, SM35, SM37
Problem Based learning sessions	7	0.28	CM35, CM36, CM37, KM37, KM38, KM39, SM35, SM37
Seminars	1	0.04	CM35, CM36, CM37, KM37, KM38, KM39, SM35, SM37

The subject of Pharmacology consists of four modules of activities:

Theoretical lessons:

The student must acquire the scientific-technical knowledge of this subject attending classes and complementing them with personal work. At the beginning of the academic year, the student will be given a detailed calendar of the topics that will be dealt with throughout the course, as well as the bibliography that will have to consult to prepare each theoretical lesson. The teaching of each subject will be based on theoretical lessons. Some of the topics will be prepared autonomously by the students and discussed later in the lectures, if any.

Laboratory practices:

Sessions of observation and practical learning of techniques that are used in the study of drugs. Group working and self-learning will be encouraged.

Problem Based Learning sessions:

This activity consists in: i) exposure of relevant pharmacological issues in the social field, which are not included in the theoretical program, and interactive explanation teacher-student to learn how to perform scientific reasoning and where to find bibliographic sources; and ii) discussion of cases based on a pharmacological issue that has not necessarily been exposed in the theoretical classes.

Supervised activities:

The students will use virtual animal experimentation models to learn working on methodological aspects that are used in pharmacology laboratories, as well as to reinforce understanding of some knowledge exposed in theoretical lectures.

Autonomous activities:

Preparation of cases that are presented and discussed in Problem Based Learning sessions. Completion of problems presented in one of the practice activities and personalized tutorials.

Use of Artificial Intelligence (AI): The use of AI technologies is permitted only for support tasks (such as information search, text correction, or translations) and in specific activities as indicated. Students must clearly identify the parts generated with AI, specify the tools used, and include a critical reflection on how these influenced the process and final outcome. Non-transparent use of AI will be considered a breach of academic integrity and may result in penalties.

Annotation: within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes
Partial evaluations	35% (proof of knowledge) + 35% (test of reationship) of the final mark	3	0.12	CM35, CM36, CM37, KM37, KM38, KM39, SM35, SM37
Assessment of the laboratory practicals	10%	2	0.08	CM35, CM36, CM37, KM37, KM38, KM39, SM35, SM37
Continuous evaluation	20%	5	0.2	CM35, CM36, CM37, KM37, KM38, KM39, SM35, SM37

Attendance at practical sessions is compulsory. Students will receive a grade of "Not assessable" when their absence exceeds 20% of the scheduled sessions.

The competences of this course will be assessed by means of:

Continuous assessment: the student must give an oral presentation on the classroom practical sessions. Participation in classroom and laboratory practical sessions will also be assessed. The average mark for all these exercises will account for 20% of the final grade.

Partial assessments: twice a year, there will be an examination of theoretical and practical knowledge consisting of two tests: a) a knowledge test and b) a test assessing the ability to establish relationships between concepts. Each test will account for 17.5% of the final grade; that is, the assessment of all these tests together will represent 70% of the final grade.

Assessment of the laboratory practicals: completion of a test based on the laboratory practicals. This activity will account for 10% of the final grade.

Each of these tests will be marked out of 10 points, and the corresponding percentages will then be applied as explained below:

17.5% -1st knowledge test- + 17.5% -1st relationship test- + 17.5% -2nd knowledge test- + 17.5% -2nd relationship test- + 20% -continuous assessment- + 10% -laboratory practicals test- = FINAL GRADE.

This sum must reach a minimum of 5 points in order to pass the course, and a mark equal to or higher than 4 out of 10 must be obtained for a section to be counted. To pass the course, the student must take part in at least 67% of the activities.

Resit exam: The resit will consist of an exam worth 70% of the student's final grade. The knowledge acquired by the student (35%) and their ability to establish relationships between concepts (35%) will be assessed. Neither the continuous assessment nor the laboratory practicals test can be retaken. In order to take part in the

resit, students must have previously been assessed in a set of activities whose weight is equivalent to at least two thirds of the total grade for the course or module. Therefore, students will receive a grade of "Not assessable" when the assessment activities completed account for less than 67% of the final grade. If a student wishes to take the resit exam despite having passed the course through continuous assessment, that is, in order to improve their grade, they waive their course grade -the 70% corresponding to the exams- and will keep the grade obtained in the resit exam. The resit exam assesses the entire course -first and second partial assessments-; the student must NOT sit only one partial assessment.

This course does not provide for the single-assessment system.

Any irregularity in an assessment activity -academic fraud, plagiarism or misuse of AI, unless such use is expressly authorised in the course guide- that may lead to a significant variation in the grade will result in that assessment activity being graded as 0. If the course guide establishes that obtaining a minimum mark in that assessment activity is an essential requirement to pass the course, or if several irregularities occur in the assessment activities of the same course, the final grade for this course will be 0. In addition, disciplinary proceedings may be initiated against any student who commits any of these irregularities.

Bibliography

Recommended bibliography by alphabetical order:

Baños Díez JE, Farré Albaladejo M. Principios de farmacología clínica: bases científicas de la utilización de medicamentos. 2.ª ed. Barcelona: Masson; 2002.

Brunton LL, Knollmann BC, editores. Goodman & Gilman: las bases farmacológicas de la terapéutica. 14.ª ed. New York: McGraw Hill; 2023.

Flórez Beledo J, Avendaño C, Mediavilla Martínez Á, editores. Farmacología humana. 7.ª ed. Barcelona: Elsevier; 2025.

Hilal-Dandan R, Brunton LL, editores. Goodman & Gilman's Manual of Pharmacology and Therapeutics. 2nd ed. New York: McGraw Hill; 2014.

Hitner H, Nagle B. Introducción a la farmacología. 5.ª ed. México: McGraw Hill Interamericana; 2007.

Lorenzo Fernández P, Moreno González A, Leza Cerro JC, Lizasoain Hernández I, Moro Sánchez MÁ, Portolés Pérez A. Velázquez. Farmacología básica y clínica. 20.ª ed. Madrid: Editorial Médica Panamericana; 2025.

Page CP, Curtis M, Walker M, Hoffman B. Integrated Pharmacology. 3rd ed. Edinburgh: Elsevier Mosby; 2006.

Ritter JM, Flower RJ, Henderson G, Loke YK, MacEwan D, Robinson E, Fullerton J. Rang y Dale. Farmacología. 10.ª ed. Barcelona: Elsevier; 2024.

Seifert R. Basic Knowledge of Pharmacology. 1st ed. Cham: Springer; 2019. doi:10.1007/978-3-030-18899-3.

Software

no need for specific software

Course groups and languages

The information provided is provisional until November 30. After this

date, you will be able to consult the language of each group through this link. To access the information, you will need to enter the course CODE