Pharmacology

Code: 100943
ECTS Credits: 6

2025/2026

Degree	Type	Year
Biotechnology	OP	4

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Teaching groups languages

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

Prerequisites

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

Objectives and Contextualisation

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

1. CM35 (Competence) Evaluate the different methodologies useful for obtaining disease models.
2. CM36 (Competence) Assess sex/gender inequalities in molecular pathology, as well as in gene therapy and in the use of vaccines and drugs.
3. CM37 (Competence) Apply the basic principles that regulate the interaction of drugs with organisms.
4. KM37 (Knowledge) Describe the basic concepts in the treatment of diseases.
5. KM38 (Knowledge) Detail the molecular bases of diseases and their various mechanisms.
6. KM39 (Knowledge) Recognize the molecular elements involved in pathogenesis.
7. SM35 (Skill) Evaluate different molecular models or organisms for disease research.
8. SM37 (Skill) Examine the steps required for the development of a drug or vaccine.

Content

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.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory practices	8	0.32	CM35, CM36, CM37, KM37, KM38, KM39, SM35, SM37, CM35
Problem Based learning sessions	12	0.48	CM35, CM36, CM37, KM37, KM38, KM39, SM35, SM37, CM35
Seminars	1	0.04	CM35, CM36, CM37, KM37, KM38, KM39, SM35, SM37, CM35
Theoretical lessons	26	1.04	CM35, CM36, CM37, KM37, KM38, KM39, SM35, SM37, CM35
Type: Supervised			

Practical computer lessons	2	0.08	CM35, CM36, CM37, KM37, KM38, KM39, SM35, SM37, CM35
Type: Autonomous			
Problem Based learning sessions	7	0.28	CM35, CM36, CM37, KM37, KM38, KM39, SM35, SM37, CM35
Problem solving	14	0.56	CM35, CM36, CM37, KM37, KM38, KM39, SM35, SM37, CM35
Study	50	2	CM35, CM36, CM37, KM37, KM38, KM39, SM35, SM37, CM35
Writting of a scientific paper	20	0.8	CM35, CM36, CM37, KM37, KM38, KM39, SM35, SM37, CM35

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 and presentation in written format of results of laboratory practices following the basic principles of a scientific manuscript. This activity includes bibliography search. 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

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Continuous evaluation	20%	5	0.2	CM35, CM36, CM37, KM37, KM38, KM39, SM35, SM37
Evaluation of a scientific paper	10%	2	0.08	CM35, CM36, CM37, KM37, KM38, KM39, SM35, SM37
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

The competences of this subject will be evaluated by means of:
Continuous assessment: Periodically and without prior notice, at the beginning / end of a theoretical lecture the student will have to answer a questionnaire / exercises related to the subject explained until that moment. In addition, the student will have to present a summary in the form of oral presentation about Problem Based Learning sessions. Participation in classroom and laboratory practices will also be evaluated. The value of the average mark of all these exercises will score 20% of the final mark.

Partial assessments: A theoretical and practical knowledge exam will consist of 2 tests per year: a) proof of knowledge; and b) proof of relationship capacity. Each test will count 17.5% of the final mark, that is, the assessment of each one of these tests will represent 70% of the final mark.
Each of these tests will be scored on 10 points and then the corresponding percentages will be applied as explained below:

17.5% (1st proof of knowledge) + 17.5% (1st test of relationship) + 17.5% (2nd proof of knowledge) + 17.5% (2nd test of relationship) + 20% (continuous assessment) + 10% of the evaluation of the work = FINAL MARK

This sum must give a minimum of 5 points in order to passthe subject and each mark from each section must have a value equal or greater than 4 points out of 10 to score in a section. To pass the subject, the student must participate in at least 67% of activities.

To participate in the recovery exam, the students must have been previously evaluated in a series of activities whose weight equals to a minimum of two thirds of the total grade of the subject. Therefore, the students will obtain the "Non-evaluable" qualification when the evaluation activities carried out have a weighting of less than 67%.

Evidence of recovery: If the student wants to participate in the recovery exam having passed the subject, in other words, the student wants to raise marks, he/she renounces to their previous marks (70% corresponding to exams) and will retain the mark of the recovery exam. The whole subject (1st + 2on proofs) will be evaluated in the recovery test.

This subject does not provide for the single assessment system.

Bibliography

Recommended bibliography by alphabetical order:

1. BAÑOS JE, FARRE M. *Principios de Farmacologia clínica: bases científicas de la utilización de medicamentos.* Ediciones Masson, 2002

2. BRUNTON LL. *Goodman and Gilman: Las Bases Farmacológicas de la Terapéutica.*Editorial McGraw-Hill Interamericana, 13ª ed., 2018

3. BRUNTON l, BLUMENTAHL D, PARKER KL. *Manual of Pharmacological Therapeutics*, EditorialMcGraw-Hill, 1ª ed, 2008

4. FLOREZ J, ARMIJO JA, MEDIAVILLA A. *Farmacología Humana*. Ediciones Elsevier España, 6ª ed, 2013

5. HITNER H, NAGLE B. *Introducción a la Farmacología*. Editorial Mc-Graw-Hill Interamericana, 5ª ed, 2007

6. KATZUNG B G, MASTERS SB, TREVOR AJ. *Farmacología básica y clínica*. Editorial McGraw-Hill Interamericana, 11a ed, 2010

7. LORENZO P, MORENO A, LEZA JC, LIZASOAIN I, MORO MA. V*elázquez. Farmacología básica y clínica.* Editorial Médica Panamericana, 17ª ed, 2005

8. PAGE C, CURTIS M, SUTTER M, WALKER M, HOFFMAN B. *Farmacología integrada*. EdicionesHarcourt Brace, 1998

9. RANG H, RITTER JM, FLOWER RJ, HENDERSON G. *Rang & Dale Pharmacology*. Elsevier, 9ª ed, 2020

10. SEIFERT R. *Basic Knowledge of Pharmacology*. Springer, 2018. https://link.springer.com/content/pdf/10.1007%2F978-3-030-18899-3.pdf

Software

no need for specific software

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PLAB) Practical laboratories	141	Catalan	first semester	afternoon
(PLAB) Practical laboratories	142	Catalan	first semester	afternoon
(PLAB) Practical laboratories	143	Catalan	first semester	afternoon

(SEM) Seminars	141	Catalan	first semester	morning-mixed
(SEM) Seminars	142	Catalan	first semester	morning-mixed
(SEM) Seminars	143	Catalan	first semester	morning-mixed
(TE) Theory	14	Catalan	first semester	morning-mixed