Universitat Autònoma de Barcelona

2020/2021

Molecular Pharmacology

Code: 100902
ECTS Credits: 6

Degree	Type	Year	Semester
2500252 Biochemistry	OT	4	0

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Other comments on languages

The use of english by students will be encouraged

Teachers

José Miguel Lizcano de Vega
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Prerequisites

Good Knowledge of the principles of Biochemistry and Signal Transduction

Objectives and Contextualisation

Molecular Pharmacology is included in therapeutic applications and is studied in the fourth year of the Degree in Biochemistry.

The objectives of the subject are to train the students in the biochemical and molecular reasoning that serves as the basis of Pharmacology and to provide them with the critical thinking capacity and discussion of topics related to the area.

Students will learn about important endogenous molecular targets susceptible to pharmacological use and / or modulation and the target interaction with the main drug families.

In order to achieve these objectives, the aim is to familiarize the student with the terminology and biochemical concepts related to drug development, the binding of drugs to receptors and / or targets, and drug actions on intracellular signaling pathways and related physiological responses.

Competences

- Apply general laboratory security and operational standards and specific regulations for the manipulation of different biological systems.
- Apply the legal and ethical principles that govern the development and application of molecular life sciences.
- Apply the principal techniques used in biological systems: methods of separation and characterisation of biomolecules, cell cultures, DNA and recombinant protein techniques, immunological techniques, microscopy techniques, etc.
- Clearly perceive current advances and possible future developments by reviewing scientific and technical literature in the area of biochemistry and molecular biology.
- Collaborate with other work colleagues.
- Describe intercellular and intracellular communication systems that regulate the proliferation, differentiation, development and function of animal and plant tissues and organs.
- Design experiments and understand the limitations of experimental approaches.
- Interpret experimental results and identify consistent and inconsistent elements.
- Manage bibliographies and interpret the information in the main biological databases, and also know how to use basic ICT tools.
- Manage information and the organisation and planning of work.
- Read specialised texts both in English and ones own language.
- Take responsibility for one's own learning after receiving general instructions.
- Think in an integrated manner and approach problems from different perspectives.
- Use ICT for communication, information searching, data processing and calculations.
- Write an article on a scientific or technical topic aimed at the general public.

Learning Outcomes

1. Apply general laboratory security and operational standards and specific regulations for the manipulation of different biological systems.
2. Collaborate with other work colleagues.
3. Correctly use the basic terminology of pharmacology and its principles.
4. Describe the principal biochemical techniques for studying the interaction between ligands and receptors and the molecular action mechanisms of drugs.
5. Design experiments and understand the limitations of experimental approaches.
6. Exemplify action mechanisms of drugs that act on membrane receptors, signal transduction, ion channels, transport systems, enzymes and gene expression.
7. Interpret experimental results and identify consistent and inconsistent elements.
8. Know and comply with the principles of bioethics and professional codes of conduct in R&D and in pre-clinical and clinical trials.
9. Manage information and the organisation and planning of work.
10. Read specialised texts both in English and ones own language.
11. Solve problems in applications of biochemistry to pharmacology and toxicology.
12. Take responsibility for one's own learning after receiving general instructions.
13. Think in an integrated manner and approach problems from different perspectives.
14. Use ICT for communication, information searching, data processing and calculations.
15. Use bioinformatic databases, algorithms and programmes to identify targets for therapy, vaccination and diagnosis.
16. Write an article on a scientific or technical topic aimed at the general public.

Content

1. Molecular Pharmacology and drug development

The different current techniques of new drug discovery and in the phases of drug development will be worked on.

2. Quantitative aspects of drug-receptor interaction

We will work mainly on the concepts: drug-receptor interaction, radioligand binding techniques, occupational theory, types of agonists and antagonists, concept of efficacy, desensitization and hypersensitivity.

3. Absorption, transport and metabolism of drugs

The routes of administration, transport and distribution of drugs, drug metabolism, variability in pharmacological response and future considerations will be introduced.

4. Molecular mechanisms of drugs that act on ion transporters and pumps: representative examples

Examples of drugs such as cocaine and ecstasy, antidepressants such as fluoxetine, diuretics such as furosemide, cardiotonics such as digoxin and gastric secretion inhibitors such as omeprazole will be worked on.

5. Molecular mechanisms of drugs that act on ion channels: representative examples

Examples of drugs such as local anesthetics, antihypertensives such as dihydropyridines and anxiolytics and hypnotics from the benzodiazepine and barbiturate family will be worked on.

6. Molecular mechanisms of drugs that act on receptors: representative examples

Drugs such as the antiasthmatics salbutamol and salmeterol, the antihistamines H1 and corticosteroids for allergies and the drugs discovered by Nobel laureate James Black will be worked on.

7. Molecular mechanisms of drugs that act on enzymes: representative examples

Drugs such as aspirin, paracetamol and ibuprofen, cholesterol synthesis inhibitors, statins, antihypertensive inhibitors of the angiotensin converting enzyme and vasodilators such as organic nitrates and phosphodiesterase inhibitors will be workedon.

8. Integration of concepts: molecular pharmacology of tumor processes

This topic will cover the biochemistry of chemotherapy, monoclonal antibodies, soluble receptors, kinase activity receptor inhibitors, multikinase inhibitors, and drugs for hormone-dependent tumor processes.

Methodology

The most relevant training activities of the subject are divided into theoretical classes, practical classes in the laboratory and with the computer, specialized seminars (public presentations) and tutorials.

Theory classes

The teacher will give an overview of the subject under study and will make an oral presentation with the help of audiovisual material to develop the aspects of special complexity. At the same time you can also comment on the material available for the other activities and propose different activities to achieve the learning of the contents and the transversal competences of the subject.

Practical laboratory and computer work

In small groups the students will carry out an experimental work that will consist of three sessions of four hours each. The aim of these practices is for students to know basic experimental pharmacological techniques, participating in the design of the experimental protocol that will later be performed in the laboratory. The results obtained will be analyzed and discussed with the aid of computers in the last session, and may also be contextualized or discussed in theory classes. Attendance at all sessions is mandatory.

Specialized seminars (public presentations)

A work will be carried out on different pharmacological and biochemical aspects of a drug in a transversal way. During the first weeks of the semester in the Moodle Classroom there will be a list of drugs that will be worked on in each course, and in groups of two students will be able to write down their preferences. The work will be carried out throughout the semester and, in the last days and within the activities scheduled for the subject, there will be a presentation of a maximum of 15 minutes for each work including the questions of the subsequent discussion in which all students and teachers of the subject will be able to participate. Attendance to all of these sessions is mandatory.

Tutorials

Activities where a tutor will advise and guide students in carrying out the work about a drug or will resolve doubts on the contents of the subject. Students and their tutor will agree on when and where the tutorials will take place, which can also be done through the Moodle Classroom.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Lectures	36	1.44	4, 8, 16, 6, 9, 7, 10, 13, 11, 3, 15
Oral presentations	4	0.16	14, 2, 4, 8, 16, 6, 9, 7, 10, 13, 11, 12, 3, 15
Practical labs	12	0.48	14, 1, 2, 4, 8, 5, 6, 9, 7, 10, 13, 11, 3
Type: Supervised			
Activities at Aula Moodle	1	0.04	14, 2, 4, 5, 6, 9, 7, 10, 13, 11, 12, 3, 15
Tutorials	2	0.08	14, 2, 4, 6, 9, 7, 10, 13, 11, 12
Type: Autonomous			
Active studying at home	57	2.28	14, 2, 4, 5, 6, 9, 7, 10, 13, 11, 12, 3, 15
Essay and prepration of oral presentation of the molecular aspects of a drug	22	0.88	14, 2, 4, 16, 6, 9, 7, 10, 13, 11, 12, 3, 15
Preparation of practical labs	4	0.16	14, 2, 4, 8, 5, 16, 6, 9, 7, 10, 13, 11, 12, 3, 15

Assessment

The evaluation will be individual and continuous. There will be different evaluation activities throughout the semester:

Laboratory practices

Teachers will evaluate laboratory practice competences through continuous assessment during the three practice sessions, the completion of an experimental protocol and a final report. These assessments will consist of 10% of the overall grade of the subject. Attendance to these sessions is mandatory. Students will obtain the grade of "Non Assessable" in case the absence is greater than 20% of scheduled sessions

Work about a drug

Students will have to carry out (in groups of two students) a work about a drug autonomously but tutored by a teacher. At the end of the course, students must submit a short written report and make a public presentation of this work. From all these activities, students will obtain a score of the work that will represent 20% of the final grade of the subject. Attendance to the oral presentations by other students is mandatory.

Partial exams 1 and 2

There will be two exams during the semester. The first corresponding to the first three topics of the subject and to the practices in the laboratory and with a weight of 25% on the final grade of the subject. The second exam will be of subjects 4-8 and will have a weight of 45%.

Retake exam

There will be a retake exam for students who fail one or both of the midterm exams (grade below 5) or want to improve on the grade obtained. To participate in this exam, you must have previously been assessed in a set of activities whose weight is equivalent to a minimum of two thirds of the total grade of the subject. Therefore, students will obtain the grade of "Non Assessable" when the assessment activities performed have a weighting of less than 67% in the final grade.

Students who have failed a midterm exam or want to score better on a midterm exam can take the exam only for that part. To pass you must have achieved a minimum grade of 4 in all midterm exams, and a weighted average of 5 in total.

Students who retake a midterm exam will automatically waive the grade they obtained prior to the midterm exam to retake.

For students who have failed both midterm exams or students who want to raise the mark of both exams, there will also be a modality to retake the entire subject. Students then agree to give up the mark of both parts and must pass this exam (grade equal to or greater than 5) in order to pass the course.

Laboratory practice grades and work about a drug are not recoverable.

The different modalities of the recovery exam will also evaluate the teaching objectives worked on in all the different training activities (theory classes, laboratory practices and specialized seminars).

Global evaluation

The final mark of the subject will be obtained from the marks of the laboratory practices (10%), work about a drug (20%), exam 1 (25%) and exam 2 (45%). The retake exam will therefore have a maximum weight of 70%.

The subject will be considered passed when the weighted score of all sections exceeds 5, and a mark equal to or higher than 4 has been taken in each of the partial exams (1 and 2) or in the corresponding part of the retake exam.

The grade of "Non-Assessable" will be obtained when the assessment activities carried out have a weighting of less than 67% in the final grade or when the absence from the compulsory practices and activities is greater than 20% of the scheduled sessions.

Voluntary use of English

To encourage the voluntary use of English by students, 0.3 points out of 10 will be added to all assessment activities if English is used correctly.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Essay and oral presentation of molecular aspects of a drug	20 %	4	0.16	14, 2, 4, 5, 16, 6, 9, 7, 10, 13, 11, 12, 3, 15
Exam 1 (Themes 1-3 and practical lessons)	25 %	2	0.08	14, 4, 5, 6, 9, 7, 10, 13, 11, 12, 3, 15
Exam 2 (Themes 4-8)	45 %	2	0.08	14, 4, 5, 6, 9, 7, 10, 13, 11, 12, 3, 15
Pratical lessons avaluation (professional actitude, essay and protocol)	10 %	4	0.16	14, 1, 2, 4, 8, 5, 6, 9, 7, 13, 11, 12, 3, 15

Bibliography

- Farmacología, 8ª Eidición. *H.P. Rang, M.M. Dale, J.M.Ritter, R.J.Flower*, Elsevier 2016
- Goodman Gilman: Las bases farmacológicas de la terapéutica, 12ª Edición. *L.L.Bruton, j.S: Lazo, K.L.Parker*, McGraw-Hill 2012
- Farmacologia Humana, 6ª ed, *J.Florez,* Masson 2013
- G protein-coupled receptors: Molecular Pharmacology. *G.Vauquelin, B.Von Mentzer* Willey 2007
- Molecular Neuropharmacology: A foundation for Clinical Neuroscience, 3rd edition. *Eric J.Nestler, Steven E. Hymna, Robert C. Malenka*. Ed. Mc Graw-Hill 2015
- Human drug metabolism. An introduction.2nd edition, *M.D.Coleman.* Wiley-Blackwell 2010
- Biochemistry and Molecular Biology Eduction: Analyzing ligand depletion in a saturation equilibrium binding experiment. pp. 428. *E Claro* . IUBMB 2006