Universitat Autònoma de Barcelona

2023/2024

Molecular Pharmacology

Code: 100902
ECTS Credits: 6

Degree	Type	Year	Semester
2500252 Biochemistry	OT	4	1

Contact

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Teaching groups languages

You can check it through this link. To consult the language you will need to enter the CODE of the subject. Please note that this information is provisional until 30 November 2023.

Teachers

Jose Miguel Lizcano De Vega

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Enrique Claro Izaguirre

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Prerequisites

Good knowledge of the principles and competences of initial courses in 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 are to train 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 some 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

- Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
- 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.
- Introduce changes in the methods and processes of the field of knowledge to provide innovative responses to the needs and demands of society.
- 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 one's own language.
- Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
- Take responsibility for one's own learning after receiving general instructions.
- Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
- 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. Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
2. Apply general laboratory security and operational standards and specific regulations for the manipulation of different biological systems.
3. Collaborate with other work colleagues.
4. Correctly use the basic terminology of pharmacology and its principles.
5. Describe the principal biochemical techniques for studying the interaction between ligands and receptors and the molecular action mechanisms of drugs.
6. Design experiments and understand the limitations of experimental approaches.
7. Exemplify action mechanisms of drugs that act on membrane receptors, signal transduction, ion channels, transport systems, enzymes and gene expression.
8. Interpret experimental results and identify consistent and inconsistent elements.
9. Introduce changes in the methods and processes of the field of knowledge to provide innovative responses to the needs and demands of society.
10. Know and comply with the principles of bioethics and professional codes of conduct in R&D and in pre-clinical and clinical trials.
11. Manage information and the organisation and planning of work.
12. Read specialised texts both in English and one's own language.
13. Solve problems in applications of biochemistry to pharmacology and toxicology.
14. Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
15. Take responsibility for one's own learning after receiving general instructions.

16. Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
17. Think in an integrated manner and approach problems from different perspectives.
18. Use ICT for communication, information searching, data processing and calculations.
19. Use bioinformatic databases, algorithms and programmes to identify targets for therapy, vaccination and diagnosis.
20. 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 reviewed.

2. Quantitative aspects of drug-receptor interaction

The concepts of drug-receptor interaction, radioligand binding techniques, occupational theory, types of agonists and antagonists, efficacy, desensitization and hypersensitivity will be worked on theoretically and practically.

3. Absorption, transport and metabolism of drugs

The routes of administration, transport, distribution, metabolism and clearance, and variability in pharmacological responses 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 reviewed.

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 analyzed.

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 reviewed. Allosterism and oligomerization in receptors and signaling bias will be introduced.

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 reviewed.

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, multi kinase 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 (drug presentations by students) and tutorials.

Theory classes

The teachers 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, they 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

Small groups of students will carry out an experimental work divided in 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 and provide matter for exams. Attendance to all sessions is mandatory.

Specialized seminars with drug presentations by students

A student 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 express 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. Teachers may decide whether oral presentations take place in the classroom or by video with videoconference. Attendance to all the sessions is mandatory.

Tutorials

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 Teams and Moodle Classroom.

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.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Lectures	36	1.44	5, 10, 20, 7, 11, 8, 12, 17, 13, 4, 19
Practical labs	12	0.48	18, 2, 3, 5, 10, 6, 7, 11, 8, 12, 17, 13, 4
Specialized seminars (Oral presentations of assays about drugs)	4	0.16	18, 3, 5, 10, 20, 7, 11, 8, 12, 17, 13, 15, 4, 19
Type: Supervised			
Activities at Aula Moodle	1	0.04	18, 3, 5, 6, 7, 11, 8, 12, 17, 13, 15, 4, 19

Tutorials	2	0.08	18, 3, 5, 7, 11, 8, 12, 17, 13, 15
Type: Autonomous			
Active studying at home	56	2.24	18, 3, 5, 6, 7, 11, 8, 12, 17, 13, 15, 4, 19
Essay and prepration of oral presentation of the molecular aspects of a drug	22	0.88	18, 3, 5, 20, 7, 11, 8, 12, 17, 13, 15, 4, 19
Preparation of practical labs	5	0.2	18, 3, 5, 10, 6, 20, 7, 11, 8, 12, 17, 13, 15, 4, 19

Assessment

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

Laboratory practices

The teaching staff will evaluate laboratory practice competences through continuous assessment during the three practice sessions, the creation and 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 and not recoverable.

Work about a drug

The students will have to work in groups of two summarize information about a drug independently but also with tutoring. At the end of the subject, a short-written report and an oral presentation of this work will be required. From all these activities, a work score will be obtained that will represent 22% of the final grade of the subject. Attendance at the oral presentations of all works on a drug is mandatory and non-recoverable.

Partial exams 1 and 2

There will be two exams during the semester. The first corresponding to the first four topics of the subject and to the practices in the laboratory and with a weight of 34% on the final grade of the subject. The second exam will be of subjects 5-8 and will also have a weight of 34%.

Retake exam

There will be a retake exam for students who fail one or both midterm exams (grade below 5) or that want to improve 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. To pass, students 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 in the prior midterm exam to retake. Laboratory practice grades and work about a drug are not recoverable. The recovery exam will also evaluate the teaching objectives worked on in all the different training activities (theory classes, laboratory practices and specialized seminars).

Exam format

The exams will consist of written questions and answers with limited space and time to answer. Teachers could complement these written evaluations with other evaluation modalities.

Global evaluation

The final mark of the subject will be obtained from the marks of the laboratory practices (10%), work about a drug (22%), exam 1 (34%) and exam 2 (34%). The retake exam will therefore have a maximum weight of 65%. 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.

Non-Assessable

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.

Unique assessment

Students who have requested a single assessment according to the procedures established by the UAB may do it for all the activities of the subject except for attendance at practices and oral presentations of the work about a drug, since these are activities mandatory and non-recoverable. The single assessment will be structured in the same way as the continuous assessment, with the same relative weight of each part, and the same system of retake exam and reviewing grades will be applied. The unique assessment will take place on the same day as the second partial exam and will include both parts 1 and 2 of the continuous assessment.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Exam 1 (Themes 1-4 and practical lessons)	34 %	2	0.08	18, 5, 6, 7, 11, 8, 12, 17, 13, 15, 4, 19
Exam 2 (Themes 4-8)	34 %	2	0.08	18, 5, 6, 7, 11, 8, 12, 17, 13, 15, 4, 19
Pratical lessons avaluation (professional actitude, essay and protocol)	10 %	4	0.16	18, 2, 3, 5, 10, 6, 7, 11, 8, 17, 13, 15, 4, 19
Specialized seminars (Essay and oral presentation of molecular aspects of a drug)	22 %	4	0.16	1, 16, 14, 18, 3, 5, 6, 20, 7, 11, 8, 9, 12, 17, 13, 15, 4, 19

Bibliography

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Software

Not defined