GENERAL INFORMATION

Name of the course: Pharmacology Research and Innovation

Code:

Type: Optativa

Location: Bellvitge's Campus

Department involved: Pathology and Experimental Therapeutics

Coordinator: Francisco Ciruela Alférez

Teachers: Francisco Ciruela Alférez, Víctor Fernández Dueñas, Sílvia Sánchez,

Credits ECTS: 3

Estimated duration of the course: 75 h
  Attendance hours: 30 h
    Lectures: 10 h
    Seminars: 10 h
    Demonstrations: 10 h
    Independent learning: 45 h

Prerequisites for the course

Basic knowledge of English (reading scientific articles on biomedical topics).

Skills developed in the course

► Transversal to the UB
  ◊ Teamwork. To develop the ability to contribute with other students into common projects.
  ◊ Responsibility and ability to learn. To have analysis and synthesis capacity, and to develop decision-making ability and adaptation to new situations.
  ◊ Ethic Commitment. To acquire a scientific critical capacity, and to display consistent and deontological attitudes.
  ◊ Communication skills. To develop the ability to understand and express themselves in English.

► Transversal to the degree
  ◊ Concern for quality. To develop skills in interpersonal relations.
  ◊ Ability to work independently.
  ◊ To achieve basic skills in managing resources related to the study area.
  ◊ Independent learning.
  ◊ Ability to interact with experts in other areas.

► Specific to the degree
  ◊ Understanding the scientific method and the ability to critically evaluate the knowledge and provided new information.
Learning objectives for the course

General objectives
- Understanding the fundamentals of action, indications and efficacy of drugs and other therapeutic interventions, and to know their contraindications, interactions and systemic effects on other organs, based on available scientific evidence.
- Learn to collaborate with others, doing teamwork.
- To learn how to graphically represent the results from different experiments. Actively participate in activities, respecting the established rules of operation.

Specific objectives
- Understanding the general principles of action of drugs and their pharmacological effects
- To interpret scientific information.
- To discuss potential therapeutic applications and possible contraindications of a drug according to their pharmacological properties.
- Understanding the bases of the interactions between drugs and their receptors
- Analyze the profile of adverse reactions and indications of a drug based on their mechanism of action.

Thematic blocks

1. Tackling pharmacological problems: from classical pharmacology to biotechnology
   1.1. Revisiting classical pharmacology: old theories new approaches
   1.2. Identifying pharmacological problems
   1.3. Modern pharmacological tools: fluorescence-based approaches, etc.
   1.4. Introducing G protein-coupled receptors as a paradigm pharmacological evolution

2. The biology of a receptor: a molecular journey!
   2.1. Receptor activation: ligand binding
   2.2. Studying receptor conformational changes: kinetics and beyond
   2.3. Dynamics of receptor G-protein coupling and G-protein activation
   2.4. How to signal: G-protein or β-arrestin?
   2.5. Receptor inactivation: desensitization, internalization and down-regulation

3. Understanding receptor-mediated signal transduction
   3.1. Effector system activation
   3.2. Second messenger generation: cAMP, calcium, cGMP, IP₃
   3.3. Second messenger targets: kinases, channels, etc.
   3.4. Protein phosphorylation-dephosphorylation

4. Cellular responses to pharmacological threats: from molecular plasticity to cellular behaviour
   4.1. Receptor oligomerization: the basis of multimodal pharmacology
   4.2. Receptor-mediated regulation of transcription factors
   4.3. Molecular and cellular plastic changes.
   4.4. Getting adapted to drugs

5. Translating basic science into clinics: sharpening the wits of the scientist!
   4.1. What are clinical needs and what clinics understand?
   4.2. Flattering scientific language to make us understand
   4.3. Examples of clinical translation

Methodology and general organization of the course

The course is divided into 5 thematic areas, in which the contents of the course work through the following learning activities:
Theoretical sessions (10 h). These sessions will present and discuss the course content among all group of students. There will be one weekly session of 2 h duration.

Seminars (10 h). Two kinds of seminars of one weekly session of 2 h duration will be performed. First, two to three seminars will be devoted to student presentations. To this end, students will be divided into groups and a pharmacological “hot topic” (i.e. Does molecular memory exists? etc.) will be chosen and prepared by students, thus an oral presentation by the students will serve to set the discussion. On the other hand, two to three seminars will be prepared by experts of the field (i.e. electrophysiology and pharmacology, etc.).

Demonstrations (10 h). To reinforce some of the main concepts presented in the theoretical sessions and seminars students will perform some practical work related to the biology of a GPCR. Thus, two consecutive days of 5 h each will serve to perform two related demonstrations:
- Ligand binding experiments of a fluorescent agonist to its receptor by means of FRET experiments.
- Second messenger (i.e. cAMP and/or Ca²⁺) determinations by using a FRET sensor.

Independent learning (45 h). Includes the study and supplementation with bibliographical sources related to the theoretical sessions and demonstrations. The organization of the course and timing of the various learning activities will be available on the Virtual Campus. In addition, the Virtual Campus will include support materials for teaching the theoretical and practical sessions, as well as enforcement activities. Finally, in this space there will be an active forum, with the aim of facilitating an effective communication tool between students and teachers with the time to ask questions throughout the year, mainly on the concepts that were studied.

Evaluation

Evaluation procedure

Continuous evaluation:
The continuous evaluation is the normal type of evaluation. The evaluation is based on attendance and active participation in seminars and theoretical sessions. In addition, a synthesis written test will be performed by the end of the course. Accordingly, the continuous evaluation of accrediting learning (knowledge, procedures and attitudes) will be in accordance with following percentages:

- Knowledge (45% of final score). Assessed by one synthesis test that will integrate the knowledge acquired along the course. This test will consist of solving multiple choice questions (25 questions, five questions for each thematic block). Each question will include three possible answers and only one will be the correct. Each question correctly scored will count 1 point, incorrect answers will count 0.5 points and unanswered 0 points. To pass the knowledge section it is necessary to score at list 22.5%.

- Procedure (50% of final score). Assessed by the evaluation of the oral presentation (25%) and the practical work (demonstrations, 25%). In both cases a short inform should be submitted. To pass this section it will be necessary at list to score 25%. In addition, an assistance of 95% of the scheduled activities (demonstrations plus seminars) will be necessary.

- Attitude (5% of final score). It will be assessed by the different activities undertaken throughout the learning process and valued positively or negatively the following: attendance, behaviour, participation, completion of work, and group work. To pass this section must exceed a score of 2.5%.

Overall, to pass the course each of the 3 sections (knowledge, procedures and attitudes) must be approved.

Single evaluation:
It is an exceptional form of evaluation. Students who wish to apply for the single evaluation process they should request it in writing during the first month of the course. The evaluation will consist of
only 1 writing test at the end of term time (final exam). The test consists of 3 sections: 1) 25 test questions; 2) 5 short developing questions; and 3) one oral question. To pass the evaluation the students must pass each of the 3 sections. To pass the course the students must pass the final exam and they should attend to all the demonstrations.

**Basic bibliography**
