

Academic Year/course: 2022/23

66018 - Advances in Molecular Pathology

Syllabus Information

Academic Year: 2022/23

Subject: 66018 - Advances in Molecular Pathology

Faculty / School: 100 - Facultad de Ciencias

Degree: 537 - Master's in Molecular and Cellular Biology

ECTS: 6.0

Year: 1

Semester: Second semester

Subject Type: Optional

Module:

1. General information

1.1. Aims of the course

The subject and its expected results respond to the following approaches and objectives:

Advances in Molecular Pathology is an optional subject that the Master in Molecular and Cellular Biology offers to its students, especially those who want to do a thesis related to biomedical aspects of Biochemistry and Molecular and Cellular Biology. Its general purpose is to provide the most recent updates of the knowledge related to some hot topics selected in molecular biopathology.

Its general objective is to acquire the knowledge of molecular and cellular biology necessary to address an accurate molecular diagnosis as well as new therapeutic strategies in selected pathologies (cancer, mitochondrial diseases, dyslipemias, lysosomal diseases) that are caused by failures in gene expression or in epigenetic regulation.

These approaches and objectives are aligned with the following Sustainable Development Goals (SDGs) of the United Nations 2030 Agenda (<https://www.un.org/sustainabledevelopment/es/>), in such a way that the acquisition of the results of subject learning provides training and competence to contribute to some extent to its achievement:

- Objective 3: Health and well-being.
- Objective 4: Quality education.
- Objective 8: Decent work and economic growth.

1.2. Context and importance of this course in the degree

The subject serves to provide advanced and updated knowledge in a series of hot topics of molecular and cellular pathology. It serves to provide basic information to adequately address the doctoral thesis and to know the main research problems raised in this area.

1.3. Recommendations to take this course

The program and content of this subject is designed to improve knowledge about the molecular basis of various relevant pathologies caused by defects in the expression of genes important for proper cell function. The basic knowledge obtained in the bachelor's degrees in the field of Life Sciences will be updated with the latest advances in each field. It is especially recommended for students who hold a degree in Biochemistry, Biotechnology or similar.

2. Learning goals

2.1. Competences

Upon passing the subject, the student will be more competent to ...

To approach with the necessary theoretical preparation the experimental work directed to the realization of his PhD thesis.

Search relevant information in the scientific literature to start an investigation or solve a methodological problem.

Prepare and present succinct and rigorous reports on various hot topics in molecular pathology

2.2. Learning goals

The student, to pass this subject, must demonstrate the following results ...

- Student will be able to understand the molecular basis of the main lysosomal diseases
- Student will be able to understand the current state of knowledge of the molecular basis of the main hereditary dyslipemias
- Student will possess advanced knowledge of the molecular mechanisms that regulate programmed cell death or apoptosis
- Student will understand the current state of research on the molecular basis of mitochondrial diseases
- Student will understand the importance of genetic and environmental factors in the genesis of obesity
- Student will understand the relationship between the inflammation process and acute phase proteins

2.3. Importance of learning goals

This course is an effective system for permanent updating the knowledge of graduates in Biochemistry and other Bachelor's degrees in Life Sciences who want to make a doctoral thesis in biomedicine.

3. Assessment (1st and 2nd call)

3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

The student must demonstrate that he has achieved the expected learning outcomes through the following assessment activities:

- Conducting a short public presentation (15 min) of one or several research articles related to any of the topics covered in the course (see program under "Activities and resources"). Next, the student will answer the questions raised by 2-3 teachers of the course for another 15 min.
- Attendance of at least 80% of the classes will be mandatory. If this is not achieved, the student will be evaluated by an examination

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The learning process designed for this course is based on the following teaching and learning tasks: Lectures on the latest developments in different research topics related to molecular pathobiology, and seminars presented by the students.

4.2. Learning tasks

The course includes the following learning tasks:

Lectures and workshops: 45 hours. The work and the latest advances in leading areas of research in molecular pathobiology will be presented to the students, as detailed in the syllabus. Besides, discussion workshops, focusing on hot and controversial topics, will take place. The teacher will do a brief presentation, based on some key articles and then, a discussion in which each student will make 1 or 2 questions related to the topic.

Elaboration and presentation of an assignment. In-class work: 8 hours; autonomous work: 60 hours. In this activity the students collect information on a particular topic, helped by the teacher. The analysis of information should lead to the elaboration of a public presentation of the chosen topic. The teacher will monitor the individual work of students in tutoring sessions. After the presentation, it will be discussed by the student and 2-3 teachers.

"The teaching and assessment activities will be carried out in person unless, due to the health situation, the provisions issued by the competent authorities and by the University of Zaragoza compel them to be carried out electronically. ?

4.3. Syllabus

1. Course introduction. Dr. Alberto Anel
2. Clinical, genetic and epidemiological characteristics of Lysosomal Disorders and its relationship with inflammatory and neoplastic complications. Dra. Pilar Giraldo.
3. Immunological features of a novel tuberculosis vaccine. Dr. Juan Ignacio Aguiló
4. Stem Cells in Cancer: features and targeting strategies. Dr. Patricia Sancho
5. Identification of nuclear factors involved in mitochondrial diseases. Dr. Patricio Fernández
6. Mitochondria, metabolism and cancer. Dr. Raquel Moreno

7. Innate immune response: mechanisms of inflammation. Acute-phase proteins. Dr. María Ángeles Alava
8. RAS genes in cancer and developmental disorders. From drug discovery to molecular imaging using genetic engineered mouse models. Dr. Alberto Jiménez Schuhmacher
9. Importance of programmed cell death. Apoptosis, Necroptosis, Autophagy. Apoptosis in *C. elegans* and *Drosophila melanogaster*. Apoptosis in mammals. Extrinsic pathway. Caspases. Caspase inhibitors. Dr. Isabel Marzo
10. Intrinsic apoptotic pathway. Inhibitors of apoptosis. Role of mitochondria in apoptosis. Cytochrome c, AIF, Smac/Diablo. Apoptosis regulation by Bcl-2 family proteins. Dr. Isabel Marzo
11. The human Apoptosis Inducing Factor: from its molecular mechanism to its functional and pathological significance. Dr. Patricia Ferreira
12. Apoptosis in the Immune System. Cell-mediated cytotoxicity. Natural Killer (NK) cells, cytotoxic T-lymphocytes (CTL) and their weapons of mass destruction. Dr. Julián Pardo
13. Apoptosis in the Immune System. Central tolerance. Mechanisms of control of peripheral tolerance. Dr. Alberto Anel
14. Introduction to the study of Reactive Oxygen Species (ROS) and Reactive Nitrogen Species (NOS). Antioxidant defences and oxidative stress. Dr. Pedro Iñarrea
15. Student evaluation seminars: Presentation and discussion of papers related to syllabus topics. Drs. Alberto Anel and Isabel Marzo

4.4. Course planning and calendar

Further information concerning the timetable, classroom, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the Faculty of Science website, the virtual platform Moodle, and the Department information boards.

4.5. Bibliography and recommended resources

Each of the corresponding teachers will indicate the specific bibliography for each topic, updated every year.