

66018 - Advances in Molecular Pathology

Teaching Plan Information

Academic year: 2024/25

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

Advances in Molecular Pathology is an elective subject of the Master's Degree in Molecular and Cellular Biology, especially aimed at those students who are beginning their third cycle studies related to biomedical aspects of Molecular and Cellular Biology. Its general purpose is to update the knowledge on some hot topics of molecular biopathology.

To this end, we will provide the knowledge of molecular and cellular biology necessary to approach an adequate molecular diagnosis as well as new therapeutic strategies in selected pathologies (cancer, mitochondrial diseases, dyslipidaemias, lysosomal diseases) that are caused by failures in gene expression or epigenetic regulation.

2. Learning results

Upon completion of the subject, the student will be able to:

- Approach with the necessary theoretical preparation the experimental work aimed at the completion of their doctoral thesis.
- Search for relevant information in the scientific literature in order to initiate a research or solve a methodological problem.
- Prepare and present succinct and rigorous reports on various hot topics in molecular pathology.

The student, in order to pass this subject, must demonstrate the following results:

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

The subject is an effective system of permanent updating of knowledge for graduates in Biochemistry, Biotechnology, Biology and other degrees related to Life Sciences (Chemistry, Veterinary Medicine) who wish to acquire the knowledge and skills necessary to undertake a doctoral thesis in the area of biomedicine.

3. Syllabus

1. Introduction to the subject.
2. Lysosomal Disorders and their inflammatory and neoplastic complications.
3. Immunological characteristics of a new vaccine against tuberculosis.
4. Stem cells in cancer: characteristics and targeted therapy strategies.
5. Identification of nuclear factors involved in mitochondrial diseases.
6. Mitochondria, metabolism and cancer.
7. Innate immune response: mechanisms of inflammation. Acute phase proteins.
8. RAS genes in cancer and developmental disorders. From drug discovery to molecular imaging.
9. Importance of cell death. Apoptosis, necroptosis, autophagy. Apoptosis in *C. elegans* and *D.melanogaster*. Apoptosis in mammals. Extrinsic pathway. Caspases. Caspase inhibitors.
10. Intrinsic pathway of apoptosis. Apoptosis inhibitors. Role of mitochondria in apoptosis. Cytochrome c, AIF, Smac/Diablo. Regulation of apoptosis by Bcl-2 family proteins.
11. Human apoptosis-inducing factor: from its molecular mechanism to its functional and pathological significance.
12. Apoptosis in the Immune System. Cell-mediated cytotoxicity. Natural killer (NK) cells, cytotoxic T lymphocytes (CTL) and their weapons of mass destruction.

13. Apoptosis in the Immune System. Central tolerance. Control mechanisms of peripheral tolerance.
14. Introduction to the study of Reactive Oxygen Species (ROS) and Reactive Nitrogen Species (NOS). Antioxidant defenses.
15. Genetics of mitochondrial diseases.
16. Genes and obesity. Relationship to inflammation.

4. Academic activities

The program includes the following activities:

- Theoretical face-to-face classes (36 h). Students will be introduced to the latest advances in cutting-edge areas of research in molecular biopathology, as detailed in the subject's syllabus.
- Preparation and presentation of a paper (4 h). In this activity, students will collect bibliographic information on a specific topic, with the help of a teacher. The analysis of the information will lead to the elaboration of a public presentation of the chosen topic. After the presentation, a discussion will be opened between the student and 2-3 professors of the subject.
- Teachers will be available to assist students' work through tutoring sessions.

5. Assessment system

The student must demonstrate that they have achieved the expected learning results through the following assessment activities:

- Compulsory attendance to at least 80% of the classes (10% of the final grade).
- Elaboration and delivery of a Powerpoint document, which will be placed in the ADD and exposed in a public presentation (15 min). The paper will deal with one or more research articles related to one of the topics covered in the subject (see "Subject syllabus"). Afterwards, the student will answer the questions posed about the presentation by 2-3 teachers of the subject, who will evaluate the presentation (90% of the final grade), for another 15 min.
- In case this requirement is not fulfilled, a written comprehensive exam on the thematic content of the program will be taken.

6. Sustainable Development Goals

- 3 - Good Health & Well-Being
- 4 - Quality Education