

**COURSE DATA****DATA SUBJECT****Code:** 46495**Name:** Cellular and molecular analysis of cell signaling**Cycle:** Master's Degree**ECTS Credits:** 3**Academic year:** 2026-27**STUDY (S)**

Degree	Center	Acad. year	Period
2254 - Master's Degree in Molecular Approaches in Health Sciences	Facultat de Medicina i Odontologia	1	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2254 - Master's Degree in Molecular Approaches in Health Sciences	Metabolic regulation and integration	COMPULSORY

COORDINATION

O'CONNOR BLASCO JOSE ENRIQUE

JIMENEZ MARTI ELENA

CASINO FERRANDO PATRICIA

SUMMARY**PREVIOUS KNOWLEDGE****RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE**

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS**COMPETENCES / LEARNING OUTCOMES****2254 - Master's Degree in Molecular Approaches in Health Sciences**

Aprender a identificar, manejar y presentar adecuadamente en informes y exposiciones públicas, conocimientos existentes sobre aspectos básicos y clínicos de señalización intercelular e intracelular,



usando como vehículo la lengua inglesa.

Conocer, comprender y manejar en la práctica métodos de estudio de la señalización mediada por moléculas de adhesión, hormonas, citocinas, quimiocinas, neurotransmisores y factores de crecimiento, así como las vías de transducción de las señales generadas por receptores.

Conocer en profundidad y comprender la organización a nivel molecular de células, sistemas y procesos de relevancia en las Ciencias de la Salud.

Conocer en profundidad y comprender las bases moleculares de la enfermedad.

Conocer en profundidad y comprender las metodologías de investigación básica aplicables a las Ciencias de la Salud.

Conocer y comprender los conceptos básicos y las implicaciones clínicas de la señalización mediada por moléculas de adhesión, hormonas, citocinas, quimiocinas, neurotransmisores y factores de crecimiento.

Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.

Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.

Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.

Students should demonstrate self-directed learning skills for continued academic growth.

Tener capacidad de analizar y sintetizar un problema.

Tener capacidad de comunicación oral y escrita en una segunda lengua científica.

Tener capacidad de desarrollar un trabajo interdisciplinar.

Tener capacidad de localizar información.

Tener capacidad de trabajar en equipo

DESCRIPTION OF CONTENTS

Topic 1. Presentation of the Subject. Definition, processes and biomedical relevance of Cell Signaling. In this lesson the concept of Cellular Signaling is defined and presented in its basic and clinical context.

Topic 2. Types of signals: Extracellular and intracellular signals.

In this lesson the concept of biological signal is defined and they are classified according to their involvement in intercellular signaling or in the intracellular transduction of external signals.



1. COMPONENTS AND MECHANISMS IN CELL SIGNALING

Topic 1. Presentation of the Subject. Definition, processes and biomedical relevance of Cell Signaling. In this lesson the concept of Cellular Signaling is defined and presented in its basic and clinical context.

Topic 3. Signaling components (I): Cell surface receptors.

In this lesson the concept of cell surface receptor and its classification are defined. The specific ligands and the mechanisms of action of the different types of surface receptors are described.

Topic 4. Signaling components (II): Signal transduction pathways.

In this lesson, the main intercellular signaling pathways are presented in their basic context and their intracellular processes and components are described.

Topic 5. Components of signaling (III): Intracellular receptors.

This lesson introduces the concept of intracellular receptor and describes the main types, with their ligands and mechanisms of action.

2. CELL SIGNALING IN THE DEVELOPMENT AND HOMEOSTASIS OF ORGANISMS

Topic 6. Cell signaling in unicellular beings.

This lesson presents the main aspects that regulate communication between unicellular beings and between them and their environment, with special emphasis on the pathological and therapeutic aspects of communication in pathogenic microorganisms.

Topic 7. Cellular Signaling of Cellular Proliferation and Death.

In the lesson, the concepts of proliferation and apoptosis are presented and the signaling pathways that control these processes are described.

Topic 8. Cellular Signaling of Tissue Development.

In this lesson the main signaling processes involved in stem cell maturation and differentiation, morphogenesis and development of organisms are studied.

3. CELL SIGNALING IN THE INTEGRATION OF CELLS AND SYSTEMS

Topic 9. Cell Signaling in the Nervous System.

In this lesson we study the main signaling processes involved in neural communication and the development of the Nervous System.

Topic 10. Cell Signaling in Hormonal Action.

In this lesson we study the main signaling processes involved in communication mediated by hormones and in the regulation of the Endocrine System.

4. CELL SIGNALING IN PATHOLOGY

Topic 12. Pathologies associated with Cell Signaling.

In this lesson we study the dysfunctions of the signaling processes that accompany different pathologies, such as cancer and diabetes. The signaling processes involved in cellular or tissue responses in pathological situations, such as infection and inflammation.

Topic 13. Cell signaling as therapeutic targets.

This lesson addresses the concept of signaling pathways as potential therapeutic targets, describing the components of pathways that are likely to be therapeutic targets and illustrating these concepts with examples in the treatment of cancer, diabetes, and immunodeficiencies.



5. TOOLS FOR STUDYING CELL SIGNALING

Topic 14. Molecular tools for signaling analysis.

In this lesson, the different molecular methodologies used to study cell signaling processes are reviewed, with practical examples of their application.

Topic 15. Cellular tools for signaling analysis.

In this lesson, the different cellular methodologies used to study cell signaling processes are reviewed, with practical examples of their application.

6. LABORATORY PRACTICALS

Practical 1: Cytomic analysis of cell signaling in cell death by apoptosis.

Practical 2: Cytomic analysis of cell signaling in the activation of leukocytes and platelets.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	20,00
Laboratory	5,00
Group work	5,00
Total hours	30,00

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	0,00
Independent study and work	0,00
Preparation of lessons	0,00
Preparation for assessment activities	0,00
Resolution of case studies	0,00
Total hours	0,00

TEACHING METHODOLOGY

EVALUATION

The evaluation of student learning will be carried out by evaluating the following sections:

1. Evaluation of the theoretical and practical contents of the subject, with questions of different formats. This test will be worth up to 90% of the final mark and will be carried out by means of a written test at the end of teaching the subject.
2. Student interest in the subject, expressed as their participation in organized discussions, answers to



questions asked by the teacher during face-to-face sessions, attendance at personal tutorials and/or any other type of activity carried out by the student in relation to the subject. From the evaluation of these concepts it will be possible to obtain up to 10% in the final grade of the subject.

REFERENCES

- Hancock, JT (2010) Cell Signalling. Oxford University Press. Gerhard Krauss (2014), Biochemistry of Signal Transduction and Regulation 5th Edition, Wiley VCH <https://awesomechem.files.wordpress.com/2016/10/biochemistry-of-signal-transduction-andregulation-5th-ed-gerhard-krauss-wiley-vch-2014.pdf> Redes de señalización y estrategias terapéuticas. Editado por JM Ortiz y M Cascales. Monografía XXIV, Real Academia Nacional de Farmacia (2008). <https://www.analesranf.com/index.php/mono/issue/view/313>
- Contemporary Aspects of Endocrinology, Edited by Evanthia Diamanti-Kandarakis. IntechOpen (2011) <https://www.intechopen.com/books/contemporary-aspects-of-endocrinology>