

**COURSE DATA****Data Subject**

<b>Code</b>	43015
<b>Name</b>	Physiological principles of biomedical research
<b>Cycle</b>	Master's degree
<b>ECTS Credits</b>	15.0
<b>Academic year</b>	2023 - 2024

**Study (s)**

<b>Degree</b>	<b>Center</b>	<b>Acad. year</b>	<b>Period</b>
2137 - M.D. in Biomedical Research	Faculty of Medicine and Odontology	1	First term

**Subject-matter**

<b>Degree</b>	<b>Subject-matter</b>	<b>Character</b>
2137 - M.D. in Biomedical Research	2 - Fundamentals of basic research in biomedicine	Optional

**Coordination**

<b>Name</b>	<b>Department</b>
PALLARDO CALATAYUD, FEDERICO VICENTE	190 - Physiology
ROMA MATEO, CARLOS	190 - Physiology

**SUMMARY**

The main objective of the module is to offer students a complete training in the physiological bases underlying the cellular processes that govern the human body, always from the perspective of its relevance and application in a biomedical research context. To do this, the syllabus has been structured around 3 large theoretical thematic units (General Physiology, Physiology of organs and systems, Systems of regulation and Integration in Physiology) and a transversal practical block, in which the contents of this syllabus together with those of the optional module of anatomical bases. Each of the theoretical units, however, will include theoretical-practical sessions either in the computer room or in the theory room itself, in which computer programs and online applications will be used to reinforce and practice the contents. Finally, the theoretical sessions will alternate with seminar sessions given both by the teaching staff and by invited external teachers, expanding the theoretical content and contextualizing it in current biomedical research first-hand by people who develop cutting-edge lines of research in pathophysiology using techniques of biomedicine.



## PREVIOUS KNOWLEDGE

### Relationship to other subjects of the same degree

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

### Other requirements

No enrollment restrictions have been specified with other subjects in the curriculum.

## OUTCOMES

### 2137 - M.D. in Biomedical Research

- To have the ability to choose the more suitable laboratory technique or techniques to deal with the research problem set out.
- To have the ability to clearly and concisely communicate conclusions, underlying knowledge and reasons to a specialised and non-specialised audience.
- 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 demonstrate self-directed learning skills for continued academic growth.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.
- To have the ability to integrate and to teamwork within a group of consolidated biomedical research.
- To know how to make a suitable bibliographical and documentary search in order to know the state of the art of the issue.

## LEARNING OUTCOMES

- To understand the regulation mechanisms of the organism.
- To understand the functioning of nervous cells, their properties and their regulation.
- To understand the functioning of central and peripheral synapses, their role in the regulation of human physiology and the pathophysiological changes in which they are involved.
- To understand the coupling, excitation and contraction in the different types of muscle and its implication in musculoskeletal homeostasis.



- To understand the mechanisms of cell secretion and its regulation systems.
- To know how to integrate the knowledge of the afferent and efferent sensory regulation pathways, the role of the central and peripheral nervous system, and neuroendocrine regulation from the point of view of human pathophysiology.
- To know the main current lines of research in pathologies of the nervous system, the musculoskeletal system, and the different organs and systems studied throughout the course.
- To be able to relate theoretical knowledge of the body's regulation systems with the pathophysiological bases of the groups of pathologies studied throughout the subject.
- To know how to carry out rigorous and exhaustive bibliographic searches to address lines of biomedical research related to human physiology.

## DESCRIPTION OF CONTENTS

### 1. UNIT I: General Physiology

LESSON 1. Homeostasis and Cellular Physiology

LESSON 2. Physiology of synaptic transmission and its pathophysiological consequences

LESSON 3. Physiology of muscle contraction and physiological bases of neuromuscular diseases

LESSON 4. General physiology of regulation systems

SEMINARS:

Channelopathies and lines of research in neurophysiology.

Intercellular signaling and molecular biomarkers.

### 2. UNIT II. Physiology of organs and systems

LESSON 5. Physiology of the circulatory system

LESSON 6. Physiology of the blood

LESSON 7. Renal and urinary tract physiology

LESSON 8. Physiology of the respiratory system

LESSON 9. Physiology of the digestive system

SEMINARS:

Pathophysiology of rare blood diseases

The Enteric Nervous System: Integrating Neural and Muscular Physiology

**3. UNIT III. Regulation and Integration Systems in Physiology**

LESSON 10. Physiology of the endocrine system

LESSON 11. Physiology of the central and peripheral nervous system: looking for the molecular bases of neurological diseases

LESSON 12. New frontiers in biomedical research on the physiology of the nervous system

**SEMINARS:**

Basics of disorders related to endocrine function

Advances in research on rare neuromuscular diseases

Adaptations to the environment: physical exercise, altitude and hyperbaric conditions.

Physiology of stress and aging: pathophysiology of diseases associated with aging.

The cases of Dr. Sacks: Unraveling Pathophysiological Mysteries

**4. PRACTICAL MODULE: Microscopic techniques in biomedical research**

LESSON 1. Theoretical Bases of Fluorescence Microscopy and Confocal Fluorescence Microscopy

LESSON 2. Theoretical Bases of Electron Microscopy

LESSON 3. Applications of microscopic techniques in biomedical research

PRACTICE 1. Applications of in vivo microscopy in biomedical research (I): Introduction, Cell migration and Wound-Healing tests.

PRACTICE 2. Introduction to the in vivo microscopy platform for multi -acquisition and Time-lapse Leica DMI8. Visualization of the results of the Wound-Healing test.

PRACTICE 3. Introduction to the PAULA in vivo fluorescence microscopy platform. Visualization of the results of the cell death assay. Final check with flow cytometry.

**WORKLOAD**

ACTIVITY	Hours	% To be attended
Theory classes	60,00	100
Laboratory practices	30,00	100
Attendance at events and external activities	20,00	0
Development of individual work	50,00	0
Study and independent work	60,00	0
Readings supplementary material	50,00	0
Preparation of evaluation activities	50,00	0
Resolution of case studies	35,00	0
<b>TOTAL</b>	<b>355,00</b>	



## TEACHING METHODOLOGY

The theoretical classes will use the participatory lecture methodology; For some theoretical topics, however, flipped classroom techniques and problem-based learning using computer programs will be incorporated, as well as group work and debate techniques for the development of the seminars.

In the program of the subject a time of tutorials is foreseen, that the students will be able to use of individual or collective form. From the theoretical and practical sessions, the use of these tutorials in relation to specific aspects of the program will be encouraged. For face-to-face tutorials, students must request the tutorial in advance by email. In addition, there will be an electronic tutorial in which you can make as many queries as you wish, which will be answered as fast as possible. The professors' e-mail is displayed on the Department of Physiology website and will be distributed to students at the presentation session.

The Virtual Classroom of the course will serve as an open forum for discussion to resolve issues that occur during the class, as well as to complement the tutorials in an open manner. It will also be used as a repository for complementary resources online or provided by the teachers of the course.

## EVALUATION

The evaluation will be carried out continuously. The theoretical contents of each block will be evaluated through specific questionnaires through the virtual classroom of the course, as well as through activities and exercises in a timely manner, always through said virtual environment. The seminars will involve discussion groups and the presentation of individual and/or group work. Attendance to 80% of the practice sessions is considered mandatory.

## REFERENCES

### Basic

- Cellular Physiology and Neurophysiology. Mordecai Blaustein, Joseph K.D. Matteson. 3ª Ed. Mosby Physiology Series. 2019. Editorial Elsevier. ISBN: 9780323596190.
- Berne y Levi. Fisiología. Bruce M. Koeppen, Bruce A. Stanton. 17ª Ed. 2018. Editorial Elsevier. ISBN: 9788491132585.
- Fisiología Humana. Un enfoque integrado. Dee Unglaub Silverthorn. 8ª Ed. 2019. Editorial Panamericana. ISBN: 9786078546220.

### Additional

- Fisiología Humana. Stuart Ira Fox. 14ª Ed. 2016. Editorial McGraw-Hill Interamericana. ISBN: 9786071514134.
- Guyton & Hall. Tratado de fisiología médica. John E. Hall. 14ª Ed. 2021. Editorial Elsevier. ISBN: 9788413820132.