

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

<b>Code</b>	43750
<b>Name</b>	Bridging courses in physiology
<b>Cycle</b>	Master's degree
<b>ECTS Credits</b>	6.0
<b>Academic year</b>	2022 - 2023

**Study (s)**

<b>Degree</b>	<b>Center</b>	<b>Acad. Period year</b>
2167 - Form.Comp. Máster Fisiología	Faculty of Medicine and Odontology	First term

**Subject-matter**

<b>Degree</b>	<b>Subject-matter</b>	<b>Character</b>
2167 - Form.Comp. Máster Fisiología	1 - Complementos formativos de fisiología	Optional

**Coordination**

<b>Name</b>	<b>Department</b>
ORTEGA VALERO, ANGEL LUIS	190 - Physiology

**SUMMARY**

The objective of the current leveling course is to supplement students' lack of basic knowledge in cellular and general physiology in some degrees.

The study begins with cellular physiology, complemented by an integrated and general study of the different systems of the body. Therefore, an integrative and basic vision is offered, from the physiological mechanisms at the most basic level to the idea of the functioning of the human body as a unit.

**PREVIOUS KNOWLEDGE****Relationship to other subjects of the same degree**



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

### **Other requirements**

Knowledge of general chemistry, organic chemistry, biology, and physics is recommended.

## **OUTCOMES**

### **2167 - Form.Comp. Máster Fisiología**

- 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.
- To acquire basic skills to develop laboratory work in biomedical research.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.
- To prepare a clear and concise memory of the results of your work and the conclusions obtained.
- To acquire a critical attitude that allows you to make reasoned judgments and defend them with rigor and tolerance.
- To acquire basic skills to develop laboratory work in biomedical research.
- To manage the use of laboratory techniques taking into account the basic principles of quality control, risk prevention, safety and sustainability.
- To acquire specific skills to develop laboratory work in cardiovascular research.

## **LEARNING OUTCOMES**

Obtain the fundamental knowledge of physiology to understand the specialized content developed in the master.

Know the basic methodology for studying the functions of the organism.

Apply the scientific method in solving experimental work and the correct use of basic scientific instruments in physiology.



## DESCRIPTION OF CONTENTS

### 1. Introduction to the study of Physiology

- A. Definition and objectives of the Physiological Sciences
- B. Levels of functional organization.
- C. Internal environment and homeostasis

### 2. Macromolecules

- A. Carbohydrates
- B. Lipids
- C. Proteins
- D. Nucleic Acids

### 3. The cell

- A. Cell membranes
- B. Cytoplasm
  - Cytosol
  - Endoplasmic reticulum
  - Golgi apparatus
  - Lysosomes
  - Mitochondria
  - Peroxisomes
  - Cytoskeleton
- C. Nucleus
- D. Eukaryotic vs. Prokaryotic Cell

### 4. Cell nucleus and gene expression

- A. Nuclear structure
- B. Genome and Proteome
- C. Chromatin
- D. DNA replication
- E. Synthesis of RNA
  - Genetic transcription
  - RNA types
  - RNA interference



## 5. Proteic synthesis

- A. Genetic translation
- B. Transfer RNA
- C. Formation of a polypeptide
- D. Endoplasmic reticulum and Golgi apparatus functions
- E. Degradation of proteins
- F. Enzymes as catalysts

## 6. Division and cell death

- A. The cell's life cycle
  - Cell signaling
  - Cellular cycle
  - Cell death
- B. Mitosis
  - Description and stages of mitosis
  - Telomeres and cell division
- C. Meiosis
  - Description and stages of meiosis
  - Genetic recombination
- D. Epigenetic inheritance

## 7. Functions of cell membranes. Passage of substances. Receivers. Chemical messengers

- A. Introduction
- B. Cell membrane: structure and composition.
- C. Transport across the cell membrane
  - Simple diffusion
  - Facilitated dissemination
  - Active transport
  - Secondary active transport or coupled transport
  - Endocytosis and exocytosis: mass transport
- D. Intercellular communication
- E. Messengers and receptors

## 8. Excitability. Membrane potentials

- A. Introduction
- B. Membrane potential. The membrane as an electric bipole
- C. Ion distribution across the membrane
  - Genesis of the membrane potential
  - Physical basis of the membrane potential
  - Diffusion force
- D. Electrochemical potential difference



E. Channels that regulate membrane potential

## 9. Action potential and ionic theory of nerve impulse

- A. Introduction
- B. Cell excitability
  - Electrical activity of axons
  - Theory of local circuits
- C. Action potential: Propagation and characteristics.
- D. Stimulus intensity
- E. Spatial and temporal summation
- F. Refractory period
- G. Types of action potential

## 10. Synaptic transmission

- A. Introduction
- B. Electrical synapses
- C. Chemical synapses
- D. Synaptic integration
- E. Refinement of synaptic efficiency

## 11. Effectors. Skeletal muscle excitation and contraction

- A. Introduction
- B. General characteristics of skeletal muscle
- C. Contractile Strands
- D. Muscle contraction
- E. Neuromuscular junction
- F. Coupling excitation contraction
- G. Energetics of muscle contraction
- H. Mechanics of muscle contraction
- I. Factors affecting strength

## 12. Smooth muscle excitation and contraction

- A. Introduction
- B. General characteristics of smooth muscle
- C. Myofilaments
- D. Types of contraction
- E. Smooth muscle contraction
- F. Relaxation of smooth muscle
- G. Neurological and hormonal control of smooth muscle contraction



### **13. Physiology of the heart muscle**

- A. Introduction
- B. General characteristics of the heart muscle
- C. Anatomy of the heart muscle
- D. Action potential of the heart muscle
- E. Coupling of excitation-contraction. Differences with skeletal muscle
- F. Muscle contraction
  - Automatic electrical rhythm of sinus fiber
- G. Transmission of cardiac impulse

### **14. Physiology of the circulatory system**

- A. Generalities of the cardiovascular system.
- B. Functions of circulation.
- C. Components and functional morphology: The heart pump and ducts

### **15. Cardiac electrical activity**

- A. Myocardial tissue as functional syncytium.
- B. Electrophysiological characteristics of cardiac cells: resting and action potential.
- C. Cardiac conduction system and automation

### **16. Cardiac Mechanics: Cardiac Cycle and Output**

- A. Concept and phases of the cardiac cycle.
- B. Analysis of pressure and volume variations.
- C. Heart sounds. Preload and afterload concept.
- D. Concept of cardiac output and its regulation.

### **17. Hemodynamics**

- A. Major and minor circulation.
- B. Distribution of circulatory volume. Flow, pressure and resistance.
- C. Hemodynamics of arterial and venous circulation.
- D. Hemodynamics of microcirculation.
- E. Relationship with the lymphatic system





### 18. Capillary and lymphatic circulation

- A. Concept and functions of microcirculation.
- B. Hemodynamic characteristics.
- C. Capillary exchange and fluid displacement.
- D. Organization and functions of the lymphatic circulation.
- E. Lymphatic Hemodynamics: Flow and factors that determine it.

### 19. Special Circulations

- A. Coronary blood flow.
- B. Characteristics of the coronary circulation.
- C. Pulmonary blood flow. Pressures and resistances in the pulmonary system.
- D. Characteristics of the cerebral, splanchnic, skeletal muscle, and skin circulation.

### 20. Introduction to the integration of physiological functions

- A. Introduction
- B. Concept of system
- C. Concept of homeostasis
- D. Regulation of the functions of systems

### 21. Autonomic nervous system (SNA)

- A. Introduction
- B. SNA regulatory functions
- C. Integration of SNA functions

### 22. Case study: regulation of homeostasis by SNA

- A. Common reading of the case
- B. Resolution of the case by the students
- C. Discussion of responses

### 23. Case study: SNA and sport. 1st part

- A. Common reading of the case
- B. Resolution of the case by the students
- C. Discussion of responses



#### 24. Case study: SNA and sport. 2nd part

- A. Common reading of the case
- B. Resolution of the case by the students
- C. Discussion of responses

#### 25. Case study: endocrine system and SNA

- A. Common reading of the case
- B. Resolution of the case by the students
- C. Discussion of responses

### WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	36,00	100
Seminars	15,00	100
Laboratory practices	9,00	100
<b>TOTAL</b>	<b>60,00</b>	

### TEACHING METHODOLOGY

- Participatory theoretical lessons.
- Practical laboratory lessons. They include introductory seminars, carrying out the practices with the follow-up and support of the teacher and carrying out a memory or a written test about them.
- Seminar classes.
- Debate and directed discussion on the work and practices carried out.

### EVALUATION

#### Evaluation system:

- Written examen consisting of 25 multiple choice questions: evaluation up to 10 points.

Attendance at 80% of the practices is compulsory.

Minimum passing grade: 5 points.





## REFERENCES

### Basic

- ALBERTS. Biología Molecular de la Célula. Ed. Omega.
- BERNE Y LEVY. Fisiología. Ed. Elsevier.
- CONTI. Fisiología Médica. Ed. Mc Graw Hill.
- COSTANZO. Fisiología. Ed. Elsevier.
- FOX. Fisiología Humana. Ed. McGraw-Hill Interamericana.
- GANONG. Fisiología Médica. Ed. Mc Graw Hill.
- GUYTON. Tratado de Fisiología Médica. Ed. Elsevier.
- LEWIN. Genes IX. Ed. Mc Graw Hill.
- MULRONEY Y MYERS. Netter. Fundamentos de Fisiología. Ed. Elsevier.
- SILVERTHON. Fisiología Humana. Un enfoque integrado. Ed. Panamericana.
- THIBODEAU Y PATTON. Estructura y función del cuerpo humano. Ed. Elsevier.
- TORTORA Y DERRICKSON. Principios de Anatomía y Fisiología. Ed. Panamericana.
- TRESGUERRES. Fisiología Humana. Ed. Mc Graw Hill.

### Additional

- BERG, TYMOCZKO Y STRYER. Bioquímica. Ed. Reverté.
- FERNÁNDEZ N. Manual de Laboratorio de Fisiología.
- PUTZ Y PABST. Atlas de Anatomía Humana Sobotta. Ed. Panamericana.
- YONG Y HEATH. Wheaters Histología Funcional. Ed. Harcourt.