

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

<b>Code</b>	33148
<b>Name</b>	Human physiology
<b>Cycle</b>	Grade
<b>ECTS Credits</b>	7.5
<b>Academic year</b>	2022 - 2023

**Study (s)**

<b>Degree</b>	<b>Center</b>	<b>Acad. year</b>	<b>Period</b>
1109 - Degree in Biochemistry and Biomedical Sciences	Faculty of Biological Sciences	3	Second term

**Subject-matter**

<b>Degree</b>	<b>Subject-matter</b>	<b>Character</b>
1109 - Degree in Biochemistry and Biomedical Sciences	11 - Integración fisiológica y fisiopatológica	Obligatory

**Coordination**

<b>Name</b>	<b>Department</b>
GARCERA ZAMORANO, MARIA DOLORES	357 - Cellular Biology, Functional Biology and Physical Anthropol.
RAMO ROMERO, JOSE JUAN DEL	357 - Cellular Biology, Functional Biology and Physical Anthropol.

**SUMMARY**

The subject "HUMAN PHYSIOLOGY" is part of the art "Physiological and pathophysiological integration" in the degree of Biochemistry and Biomedical Sciences of the University of Valencia and it is located in the third year. It consists of 7.5 ECTS credits (187.5 hours of student work), which include face-to-face and remote activities. This is a subject of synthesis, in which the students should understand the functional relationships between the different parts of the human being as well as coordination actions that occur between them, and which are necessary for its operation as a whole.



## PREVIOUS KNOWLEDGE

### Relationship to other subjects of the same degree

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

### Other requirements

In previous years, the students will have acquired the basic skills needed to meet the objectives of the course. Subjects such as "Physics", "Chemistry", "Cell Organization" and "Intracellular dynamics and signaling" as well as others that are taught in the first quarter of the course, as "Functional histology" and "Metabolism and regulation" are fundamental in the acquisition of basic background knowledge, crucial to understand the functioning of human body.

## OUTCOMES

### 1101 - Degree in Biochemistry and Biomedical Sciences

- Conocimiento de la organización estructural y funcional de los tejidos y órganos animales.
- Comprender el funcionamiento del animal como un todo integrado reforzando el papel de los sistemas de coordinación e integración.

## LEARNING OUTCOMES

- Obtain an integrated vision of human functioning, to understand the meaning of the acquired knowledge, interrelating them and implement them.
- Capacity for data analysis, choice of the appropriate method, evaluation and critical interpretation of experimental results in its various forms of expression (tables, graphs...)
- Having skill in the handling of laboratory animals.
- Ability to build a written text understandable and organized.
- Capacity for speaking to an auditorium audience, for example the class itself, through the presentation or the speech in a debate on an issue or controversial issue.
- Ability to argue from rational criteria, clearly differentiating what is opinion of what facts or accepted scientific evidence.
- Professional training. Acquisition of scientific and technical knowledge related to the physiology that will make it possible to exercise professions and civic responsibilities in a continuous increase in technological society.



## DESCRIPTION OF CONTENTS

### 1. INTRODUCTION

ITEM 1. INTRODUCTION TO PHYSIOLOGY. Physiological systems.- Functions and processes.- Homeostasis and pathophysiology.- Functional compartments of the body.- The integrative physiology as a science.

Long-distance communication: neural signals, hormones and neurohormones.- Control pathways: response and feedback loops.- Reflex control.

### 2. HOMEOSTASIS AND CONTROL

ITEM 2. INTRODUCTION TO THE ENDOCRINE SYSTEM. Hormones.- Classification.- Control of hormone release: hypothalamic-pituitary system.- Hormone interactions.

ITEM 3. INTRODUCTION TO THE NERVOUS SYSTEM. Organization of the nervous system.- Electrical signals in neurons.- Intercellular communication synapse.- Integration of neural information.

ITEM 4. THE CENTRAL NERVOUS SYSTEM. White matter vs. gray matter.- Cerebrospinal fluid.- The spinal cord.- Nervous function: the brain stem, the cerebellum, the diencephalon, the cerebrum.- The cerebral cortex and its functional areas: sensory and motor integration.

ITEM 5. SENSORY PHYSIOLOGY. General properties of sensory systems.- Somatic senses.- Chemoreception: Smell and taste.- Mechanoreception: hearing and equilibrium.- Photoreception: the eye and vision.

ITEM 6. SOMATIC AND AUTONOMIC CONTROL. The autonomic nervous system.- Autonomic reflexes. - Functional Anatomy: sympathetic-parasympathetic division.- Autonomic Neurotransmitters.- The somatic motor division: functional anatomy.- The neuromuscular junction.

ITEM 7. MUSCLE PHYSIOLOGY. Isometric and isotonic contraction. Nervous control of skeletal muscle. Neural reflexes. Autonomic reflexes. Skeletal muscle reflexes. Integrated control of body movement.

### 3. INTEGRATION OF FUNCTION

ITEM 8. RESPIRATORY PHYSIOLOGY. Functional anatomy of the respiratory system.- Lung volumes.- Ventilation: inspiration and expiration.- Surfactant.- Efficiency of breathing.

ITEM 9. GAS EXCHANGE AND TRANSPORT. Gas exchange in the lungs and tissues.- Transport of blood gases: oxygen and carbon dioxide.- Regulation of ventilation.- Respiratory pathophysiology.

ITEM 10. CARDIOVASCULAR PHYSIOLOGY. Overview of the cardiovascular system.- Functional anatomy of the heart: the cardiac action potential.- Electrical conduction in the heart: cardiac cycle.- Cardiac Output.- Nervous and endocrine control of heart activity.

ITEM 11. BLOOD PRESSURE AND BLOOD FLOW. The blood vessels.- Blood Pressure.- Resistance in the arterioles.- Exchange at the capillaries.- Lymphatic system.- Regulation of blood pressure.- Cardiovascular disease.



ITEM 12. RENAL FUNCTION. Functional anatomy of the kidney.- Overview of kidney function: filtration, reabsorption, secretion.- Micturition.

ITEM 13. FLUID AND ELECTROLYTE BALANCE. Water balance: the role of the loop of Henle.- Control of water balance.- Control of salt balance: renin-angiotensin-aldosterone system and other hormones.- Integrated control of volume and osmolality.

ITEM 14. ACID-BASE BALANCE. Importance of homeostasis.- Buffer systems.- Control of pH by ventilation.- Kidney control of acid-base balance.

#### **4. METABOLISM AND GROWTH**

ITEM 15. REGULATION OF BODY TEMPERATURE: heat production and loss by the body. Response to high and low temperatures. Physiological and pathological reconfiguration of the hypothalamic thermostat

ITEM 16. DIGESTIVE PHYSIOLOGY. Functional anatomy of the digestive system.- Gastrointestinal motility.- Digestive secretions.- Regulation of digestive function: role of the nervous and endocrine systems.- Cephalic, gastric and intestinal phases of digestion.- Absorption.

ITEM 17. ENDOCRINE CONTROL OF GROWTH AND METABOLISM. Homeostatic control of nutrient metabolism: insulin-glucagon relationships.- Diabetes.- Adrenal glucocorticoid: functions and control of secretion.- Response to stress.- Growth hormone: functions and control of secretion.- Thyroid hormones: functions and control of secretion.- Tissues and bone growth: Hormonal control of calcium homeostasis

ITEM 19. ENDOCRINE CONTROL OF REPRODUCTION. Basic patterns of reproduction: gametogenesis.- Male reproduction: hormonal control of spermatogenesis.- Female reproduction: hormonal control of the menstrual cycle.- Sexual response in humans.- Pregnancy, parturition and lactation.

#### **5. LABORATORY AND SIMULATION PRACTICES**

Effect of temperature on the oxygen consumption of aquatic animals.

Absorption spectrum of haemoglobin depending on its degree of saturation with oxygen.

Regulation of color change in animals.

Study of the effect of juvenile hormone treatment on insect larvae / nymphs.

Effect of temperature on heartbeat in *Daphnia*.

Salinity and volume regulation in polychaete worms.

Study of sensory receptors in humans.

Electromyography (BIOPAC Student System). Electrocardiography.

Human blood pressure study.

Spirometry Analysis of lung volumes and capacities.

In situ observation of chloride cells in *Artemia*.

Study of the estrous cycle in the albino mouse.

Computer simulation of various physiological processes related to the endocrine system (metabolism and hormones).





Computer simulation of various physiological processes related to the muscular system. Skeletal muscle physiology.

Computer simulation of various physiological processes related to the circulatory system. Frog cardiovascular physiology.

Computer simulation of various physiological processes related to the circulatory system. Cardiovascular dynamics.

Computer simulation of various physiological processes related to the respiratory system. Mechanisms of the respiratory system.

Computer simulation of various physiological processes related to the digestive system. Physical and chemical processes of digestion.

Computer simulation of various physiological processes related to the excretory system. Renal physiology.

Computer simulation of various physiological processes related to the nervous system. Neuro-physiology of nerve impulses.

## 6. TUTORIAL SESSIONS

They will be planned throughout the course, lasting one or two hours and in them, activities focused on the pathophysiological aspects will be proposed to the students, such as solving practical cases after providing them information on specific symptoms, as well as activities of problem solving.

## 7. JOURNAL CLUB

Critical analysis of scientific articles (transversal activity) carried out jointly with the rest of the subjects of the same course.

## 8. OTHER ACTIVITIES

Online questionnaires through Virtual Classroom

## WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	48,00	100
Laboratory practices	24,00	100
Tutorials	3,00	100
Development of group work	5,00	0
Development of individual work	6,00	0
Study and independent work	15,00	0
Preparation of evaluation activities	40,50	0
Preparing lectures	35,00	0
Preparation of practical classes and problem	7,00	0



Resolution of online questionnaires	4,00	0
<b>TOTAL</b>	<b>187,50</b>	

## TEACHING METHODOLOGY

The teaching methodologies of the different activities (face-to-face and non-face-to-face) are described here.

**Theory lectures, of a masterly type**, will be taught sequentially throughout the academic year, so that they are integrated with the rest of the proposed activities.

**Practical laboratory and simulation exercises.** The total face-to-face laboratory hours are divided into 7 sessions of three hours each. In each session the students, in pairs, carry out the proposed activities after having read the instructions previously provided. It is necessary to attend at least 70% of the face-to-face laboratory sessions in order to take the practical exam. The practical simulation exercises will be carried out remotely. Computer simulations based on PhysioEx 9.0 software for Human Physiology will be proposed (see bibliography).

In the 6 hours of **Tutorials**, interactive activities (individually or in groups) will be proposed to consolidate the skills of the subject. These activities may be evaluated in the theoretical evaluation tests.

### Journal Club

Critical analysis of scientific articles: the activity allows students to acquire transversal competences, different from those acquired in theoretical and practical sessions. This activity aims to train the student in reading scientific papers (which necessarily implies reading in technical English), bringing them closer to the original scientific literature. This is the source from which new knowledge is obtained and allows the development and advancement of biomedical sciences. This compulsory activity will be organized jointly with the rest of the third-year subjects. According to the number of credits of each subject from 3 to 6 articles will be analysed. The preparation, presentation and debate (for 30 minutes) of the articles will be carried out in groups of 2 students and will be supervised by the teacher through tutorial sessions.

**Other activities.** Throughout the course multiple choice questionnaires will be proposed through a virtual classroom, which will allow the student to review their knowledge gradually.

## EVALUATION

The **evaluation of the theory** will be carried out in two tests (which will eliminate subject matter) that will contain questions of different types (reasoning, definitions, schemes, etc...) and multiple-choice questions. The mark of all two tests can be compensated from 4. If the student does not pass these tests, he/she will have to sit the second sitting.



The **evaluation of the practices** will be carried out by means of a practical exam in the laboratory with the resolution of two practical cases "in situ". On the same day of the practical exam, a multiple choice questionnaire will be carried out with questions corresponding to the laboratory sessions and the simulation practices.

For the evaluation of the **activity of critical analysis of scientific articles**, the following evaluation criteria will be taken into account: knowledge and understanding of the information contained in the articles, correct use of terminology and oral expression skills. Integration with other theoretical and practical contents of this or other subjects of the degree may also be valued. A maximum score of 10 points may be obtained, 5 points being necessary to pass this activity. The grade obtained will represent 5% of the final grade for each of the third year subjects participating in this activity. If the student does not reach the required minimum grade, she will suspend the subject in which she performs said activity. Likewise, the participation of the rest of the students in the presentation and debate sessions may be taken into account by the teacher to modulate the final grade for the subject.

The distribution over a maximum of 100 points will be as follows (50 POINTS MUST BE REACHED TO PASS THE SUBJECT):

## **THEORY (60%)**

<b>Theory exam questions</b>	<b>40 points</b>
<b>Test questionnaires</b>	<b>20 points</b>

## **PRACTICES (30%)**

<b>Practical cases</b>	<b>20 points</b>
<b>Laboratory practice simulation questionnaire</b>	<b>10 points</b>

## **OTHER ACTIVITIES (5%)**

<b>Assistance and use of tutoring and problems</b>	<b>5 points</b>
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## **JOURNAL CLUB ACTIVITY (5%)**

<b>Journal Club</b>	<b>5 points</b>
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<b>TOTAL</b>	<b>100 POINTS</b>
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## **Particular conditions**

In order to pass the course, it is **a necessary condition to pass both the theory and the practices (equal or superior to 5)**. Only in that case will the grades obtained in the rest of the activities be added. In case of not reaching the minimum score in any of the two parts (theory or practical), the score of the part passed can be saved for a full academic year.



The second call of the theoretical part will also consist of an exam with multiple choice questions and questions.

In the second call, the practical exam will be similar to that of the first call.

## REFERENCES

### Basic

- Silverthorn, D.E. (2019) Fisiología Humana. Un enfoque integrado. 8ed. Editorial Médica Panamericana. Madrid (Disponible on line Universitat de València)
- Fox, S.I (2013). Fisiología Humana. 13a Edición. Mc Graw Hill. Madrid.
- Sherwood, L (2016) Human Physiology: From Cells to Systems, 9th Edition. Brooks/Cole Cengage Learning.
- Koeppen, BM y Stanton, B.A. (Eds) (2009). Berne y Levy Fisiologia. 6a Edición. Elsevier España, Barcelona.
- Zao, P., Stabler, T., Smith, L., Lokuta, A., Griff, E. (2012) PhysioEx 9.0. Simulaciones de laboratorio de Fisiología. Pearson Educación. S.A. Madrid.
- Widmaier, E.P., Raff, H., Strang, K.T. (2019). Vanders Human Physiology 15th Edition. Mac Graw Hill. New York

### Additional

- Ganong, W.F. (2013). Fisiología médica. 24a Edición. Mc Graw Hill. Madrid
- Guyton, A.C. (2016). Tratado de fisiología médica. 13a Edición. Elsevier.
- Hill, R.W., Wyse, G.A. y Anderson, M. (2016) Animal Physiology. 4th Edition. Sinauer Associates, Inc, Sunderland, Massachusetts
- Stanfield, C.L. (2011). Principios de Fisiología Humana. 4th Edition. Addison Wesley (Pearson). Madrid
- Widmaier, E.P., Raff, H, Strang K.T. (2014). Vanders Human Physiology. The Mechanisms of Body Function. 13th Edition. Mc Graw Hill.