

HUMAN AND CELL PHYSIOLOGY I

(approved by the Department Council on 22nd May, 2017)

MODULE	CONTENT	YEAR	TERM	CREDITS	TYPE
MEDICINE AND PHARMACOLOGY	HUMAN AND CELL PHYSIOLOGY	2 st	1 st	6 ECTS	Obligatory
LECTURERS			CONTACT INFORMATION		
<p>Theory</p> <ul style="list-style-type: none"> Juan Llopis González M^a Inmaculada López Aliaga José Luis Quiles Morales M^a José Muñoz Alférez M^a Teresa Nestares Pleguezuelo Julio J. Ochoa Herrera Jesús M^a Porres Foulquié Javier Díaz Castro Cristina Sánchez González Virginia Aparicio García-Molina Carlos de Teresa Galván <p>Laboratory practice</p> <ul style="list-style-type: none"> Juan Llopis González José Luis Quiles Morales M^a Teresa Nestares Pleguezuelo Julio J. Ochoa Herrera M^a Dolores Yago Torregrosa Javier Díaz Castro Cristina Sánchez González 			<p>Department of Physiology, 1st Floor, Faculty of Pharmacy. Phone 958243879</p> <p>jllolis@ugr.es, milopez@ugr.es, jquiles@ugr.es, malferez@ugr.es, nestares@ugr.es, jjoh@ugr.es, jmporres@ugr.es, javierdc@ugr.es, crissg@ugr.es, virginiaparicio@ugr.es, cdeteresa@ugr.es, mdyago@ugr.es</p>		
			TUTORING AND MEETINGS		
DEGREE WITHIN THE SUBJECT IS TAUGHT			<ul style="list-style-type: none"> Juan Llopis González W: 08.30-11.30 h, 12.30-13.30 h and 17.30-19.30 h M^a Inmaculada López Aliaga 1st sem. M, W and F: 10.30-11.30 h and 12.30-13.30 h 2nd sem. M: 17.00-19.00 h; Th: 13.30-14.30 h; F: 9.00-12.00 h José Luis Quiles Morales M: 11.30-13.30 h; W: 11.30-14.30 h; F: 11.30-12.30 h M^a José Muñoz Alférez M, W and F: 10.30-11.30 h and 12.30-13.30 h M^a Teresa Nestares Pleguezuelo 1st sem. M, W and F: 12.30-14.30 h 2nd sem. M, W and F: 9.30-11.30 h Julio J. Ochoa Herrera 1st sem. M: 18.00-19.00 h; W: 11.30-14.30 h; F: 9.30-11.30 h 2nd sem. T: 8.00-11.00 h; Th: 10.00-11.00 h and 12.30-13.30 h; F: 11.00-12.00 h (2nd sem. in Faculty of Sports Sciences) Jesús M^a Porres Foulquié M and F: 11.30-14.30 h Javier Díaz Castro 1st sem. M, W and F: 17.00-19.00 h 		
Pharmacy					



	<p>2nd sem. M, W, Th and F: 16.00-17.00 h, T: 16.00-17.00 h and 18.00-19.00 h</p> <ul style="list-style-type: none"> • Cristina Sánchez González M: 11.30-14.30 h; T: 12.30-14.30 h and 16.00-17.00 h • Carlos de Teresa Galván M: 15.00-16.00 h and 19.00-20.00 h; T, W, Th and F: 15.00-16.00 h • M^a Dolores Yago Torregrosa M and W: 08.30-11:30 h
<p>PREREQUISITES and/or RECOMMENDATIONS</p>	
<p>Prerequisites: those necessary to access to the degree, related with the level of formation that the student must acquire to accede to the University.</p> <p>Recommendations: to have previous basic knowledge (background knowledge of Chemistry, Anatomy and Histology, Biochemistry, Metabolism.</p> <p>A good standard of English and informatics skills are also required.</p>	
<p>BRIEF ACCOUNT OF THE SUBJECT PROGRAMME</p>	
<p>The programme has a high degree of coherence and integration and cover a diverse range of topics, while reflecting particular strengths within the biological and life sciences and there is a clear coherence between the different modules. Physiology is a study of the normal functions of cells, organs and systems of the living body, the mechanisms by which they are achieved and the regulation of functional activities to maintain the homeostasis, therefore the programme has been divided into thematic units just for didactic purposes, but during the course we will integrate all the body systems defining their links to maintain the homeostasis. The contents are divided in: Introduction to Physiology. Functional organization of the cell. Plasma membrane. Transport across the plasma membrane. - Excitability: nerve fibers and muscle fibers. Nerve Somatic system. Endocrine system.</p>	
<p>GENERAL AND PARTICULAR ABILITIES</p>	
<p>GC9. - To intervene in the activities of promotion of health, prevention of disease, in the individual, familiar and community area with an integral and multiprofessional vision of the process health and disease.</p> <p>GC13. - To develop skills of communication and information, both oral and written, to deal with patients and users of the center where it is developed the professional activity. To promote the capacities of work and collaboration in multidisciplinary teams and those related to other sanitary professionals.</p> <p>GC15. - To recognize the own limitations and the need to support and update the professional competences, giving special importance to the autolearning of new knowledge being based on the scientific available evidence.</p> <p>EC47. - To know and to understand the structure and function of the human body, as well as the general mechanisms of the disease, molecular, structural and functional alterations and therapeutic tools to restore the health.</p>	
<p>OBJECTIVES (EXPRESSED IN TERMS OF EXPECTED RESULTS OF THE TEACHING PROGRAMME)</p>	
<p>The above mentioned objectives in this area are focus on promote that the future pharmacist acquires knowledge about the functioning of the human organism. To do so:</p> <ul style="list-style-type: none"> • Understanding the physiological processes, analyzing their biological meaning, description, regulation and integration at different levels of organization: cell, organ and body systems in health. 	



- Establish the basis for understanding the physiological adaptation process taking place due to a continuously changing environment.

DETAILED SUBJECT TOPICS

We will use **several multimedia instruments during the course** to enhance the teaching-learning process of the student. This programme has been designed taking into account the integration concept and **cover a diverse range of physiological topics, with a clear coherence between the different issues**. Physiology is a study of the normal functions of cells, organs and systems of the living body, the mechanisms by which they are achieved and the regulation of functional activities to maintain the homeostasis, therefore the program has been divided into thematic unit just for didactic purposes, although during the course we will integrate all the body systems, to understand better how they maintain a stable, constant condition.

Program theory (with aims and time schedule)

Subject 1. - Introduction to Physiology (1h)

Define the concepts of physiology, internal medium and homeostasis
Knowing the interest for a pharmacist involves the study of cell physiology and human

Subject 2. - Functional organization of the cell. Plasma membrane (1h)

Understanding the functional organization of the cell
Describe the functions of the plasma membrane
Knowing the ionic composition of the intracellular and extracellular fluids

Subject 3. - Transport across the plasma membrane (2h)

Differentiate processes of endocytosis (pinocytosis, phagocytosis) and exocytosis
Understanding the mechanisms of passive transport: simple diffusion and facilitated diffusion
Knowing the characteristics and regulation of the various kinds of ion channels.
Differentiate primary and secondary active transport
Know the characteristics and properties of the ion pumps
Knowing paracellular transport

Subject 4. - Excitability (3h)

Describe and explain the resting membrane potential and ionic bases
Describe the local potential and ion channels involved
Describe and explain the phases, properties and ionic basis of the action potential.
Knowing the excitability changes along the action potential
Describe the action potential conduction and the effect of myelin

Subject 5. - Nerve cells (1h)

To study the functions of the neuron.
Describe the process of myelinogenesis.
Knowing the properties of the neuron
Describe the events involved in the damage and peripheral nerve repair

Subject 6. - Synaptic transmission (2.5h)

Describe the main morphological characteristics of the synapse
Distinguish between electrical synapses and chemical synapses
List the steps used in the transmission of impulses across the synapse
Distinguish between excitatory and inhibitory postsynaptic potentials
Define presynaptic inhibition
Identify the various types of neural circuits in the nervous system



Differences between spatial and temporal summation
Describe the properties of the synapse
List the criteria for identifying a substance as a neurotransmitter
Describe the classification and functions of neurotransmitters
Define and classify the neuromodulators

Subject 7. - The muscle fiber (4.5h)

Describe the motor neuron-muscle ratio
Enumerate the sequence of events and ionic power ranging from the production of an action potential in the motor nerve to the contraction of a skeletal muscle
Describe how you conducted the cross-bridge cycle and shortening the sarcomere
Knowing the function of the calcium ion in the contraction-relaxation
Explain the sum of contractions and length-tension relationships and force-velocity

Subject 8. - General structure of the nervous system (3h)

Learn the basic functions of the nervous system
Knowing the functional characteristics of the cranial and spinal nerves
Know the elements of the central nervous system protection
Explain the formation, movement and function of cerebrospinal fluid
Know the meaning of the blood brain barrier

Subject 9. - General physiology of receptors (1h)

Differentiate the concepts of sensation and perception
List the types of sensory modalities
Define and classify sensory receptors
Describe the sensory transduction process and differentiate between potential and receptor potential generator
Adapting receptors. Differentiate between fast and slow
Define the concept of receptive field
Describe the process of sensory coding

Subject 10. Somato-visceral sensitivity (1.5h)

Describe the location and function of receptors of tactile, thermal and pain sensations
Describe the different types of pain
Identify proprioceptive receptors (muscle spindles and Golgi tendon organ) and describe their functions.
Describe the modes of transmission and integration somatovisceral cortical sensitivity

Subject 11. Physiology of vision (2.5h)

Know the functions of the structural components of the eyeball
Explain the role of the refraction, accommodation and constriction in imaging
Describe the functions of the photoreceptors and photopigments in vision
Adapting known vision receptors to changes in light intensity
Describe binocular vision and the ability to perceive the depth and three-dimensional nature of the objects
Understand the concept of visual acuity
Describe the processing of visual impulses in the retina and the visual pathways and centers of integration

Subject 12. Physiology of hearing and balance (2h)

Describe the functions of the structures that make up the three main parts of the ear
Describe the characteristics of a sound wave
Describe the process of capture and conveyance of a sound wave
Knowing sensory transduction in fonorreceptores
Describe the coding of frequency, intensity and sound localization



Identify pathways and nuclei involved in the neural processing of auditory information
Describe the function of the macula in the static and dynamic balance (linear acceleration and deceleration)
Describe the function of the ampullary crests in rotational acceleration or deceleration
Identify vestibular pathways and integration centers

Subject 13. Physiology of taste and smell (1.5h)

Knowing the structure of gustatory and olfactory receptors
Describe the physiology of taste and smell
Describe the pathways and centers for gustatory and olfactory sensitivity

Subject 14. Control of motor activity I. Motor function in the spinal cord and brainstem (2h)

Describe the function of the neural structures responsible for movement
Explaining spinal circuits and motor control
Describing the topographic relations
Explain the importance and function of alpha and gamma motor neuron
Describe the following spinal reflexes: the stretch reflex, flexor reflex
Describe the function of the brainstem motor: vestibular nucleus and reticular formation in the maintenance of balance and posture

Subject 15. - Control of motor activity II. Motor function in the cerebellum, basal ganglia and cortex (2h)

List the motor areas of the cerebral cortex and its relative contribution to the organization of the motor act.
Point out the differences between pyramidal and extrapyramidal motor system
Explain the role of the cerebellum in voluntary movements
Describe the afferent and efferent projections of the cerebellum
Explain the role of the basal ganglia
Describe the afferent and efferent projections of the basal ganglia
Make a diagram integrating the functions of the various structures involved in the regulation and control of motor act

Subject 16. - Higher functions of the nervous system (2h)

Explain the cellular basis of sleep-wake rhythms and their possible role
Explain the cellular basis of learning and memory

Subject 17. General organization of the endocrine system (1,5h)

Define the terms endocrine gland and hormone
Identify various endocrine glands and the hormones they secrete
List a number of criteria that identify a substance as a hormone
Know the classification of various hormones
Know the processes of synthesis, secretion and hormone transport and metabolism
Describe the types of signals that can regulate the secretion of hormones
Describe the general mechanisms of hormone action

Subject 18. Neuroendocrine integration (1,5h)

Explain the functional relationship between the hypophysis and hypothalamus
Describe the functional implications of hypothalamic-pituitary portal system
List the hormones of the adenohypophysis and neurohypophysis and explain how its secretion is regulated by the hypothalamus

Subject 19. Thyroid physiology (1,5h)

Knowing thyroid hormones
Describe the biological actions and mechanisms of regulation of thyroid hormone secretion

Subject 20. Hormonal regulation of metabolism calcium/phosphorus (2h)

Know the different types of bone cells



Describe the interaction between the plasma levels of calcium and parathyroid hormone and calcitonin
Describe the biological actions and mechanisms of regulating the secretion of parathyroid hormone, vitamin D hormone and calcitonin

Subject 21. Hormonal regulation of growth (1h)

Describe the metabolic effects and mechanisms of regulation of GH secretion
Meet other factors and hormones involved in growth

Subject 22. Physiology of the endocrine pancreas (1,5h)

Describe the major metabolic actions of insulin and glucagon and explain the regulation of its secretion

Subject 23. Physiology of the adrenal gland (1,5h)

Describe the main biological actions of cortisol
Describe the hypothalamic-pituitary-adrenocortical in controlling the secretion of glucocorticoids
Describe the actions of catecholamines and explain how they are regulated secretions of the adrenal medulla

Subject 24. Hormonal regulation of water-salt balance (1h)

Knowing the role of mineralocorticoids in the regulation of water and electrolyte homeostasis
Describe some of the major biological actions of aldosterone
Describe the biological actions of ADH and how its secretion is regulated
Describe the renin-angiotensin-aldosterone activation mechanisms and functions

LABORATORY PRACTICE PROGRAM

Practice 1.- Detailed functional study of different organs and body systems models
Practice 2.- Transport mechanisms and cell permeability (computer simulation)
Practice 3.- Neurophysiology of nerve impulses (computer simulation)
Practice 4.- Gustatory and olfactory receptors.
Practice 5.- Skeletal Muscle Physiology (simulated).
Practice 6.- Effect of thyroxine on the basal metabolism (computer simulation)
Practice 7.- Control of blood glucose. Determining the blood glucose curve

Theoretical and practical exam

For each academic year, a selection of the above list will be performed at the physiology laboratory.
Theoretical-practical exam

For each academic year, a selection of the above list will be performed at the physiology laboratory.

SYSTEM FOR ASSESSING THE ACQUISITION OF THE COMPETENCES AND KNOWLEDGE

I. Continuous Assessment

This is the default system. Continuous Assessment includes several theory exams which will take place on dates scheduled by the Faculty in coordination with the other subjects offered in the term. Prior to the exam, the lecturer will describe the structure and type of exam questions. Coursework performed by the students (essays, presentations, seminars...) as well as regular attendance and class participation will be also assessed.

The final mark will be calculated according to the following:



Theory: 70%
Laboratory practice: 10%
Coursework (presentations, seminars, etc.): 10%
Attendance to theoretical classes: 10%

A minimum mark of 5 (out of 10) in both the theory and laboratory practice sections must be obtained in order to pass the subject.

II. Single Final Assessment

According to the Students Assessment and Qualification Policy of the University of Granada (adopted by the Governing Council on Oct 26, 2016), those students who cannot follow the continuous assessment system due to working, health or disability issues (or any other reason appropriately justified) can apply for a Single Final Assessment. For this purpose, the student will submit a formal request to the Director (Head) of the Department, arguing and proving (with documented evidence) the reason for not being able to follow the continuous system. The submission deadline will be 2 weeks after the beginning of the lectures. In extraordinary circumstances, the starting date for counting the 2-week period will be the enrolment date (policy NCG78/9) and, in this case, the student will have to include the proof of enrolment date when making the request. After ten days without the student receiving a written reply from the Director of the Department, it will be understood that the request has been deemed. In case of denial, the student may file, within one month, an appeal to the Rector, who may delegate this task to the Dean or Director of the Centre, exhausting the administrative proceedings.

For students in the Single Final Assessment system, the final mark will be calculated according to the following:

Theory: 90%
Laboratory practice: 10%

A minimum mark of 5 (out of 10) in both the theory and laboratory practice sections must be obtained in order to pass the subject.

BIBLIOGRAPHY



Print Books on Physiology

- CORDOBA, A. "Physiology Dynamics". Barcelona: Ed. Masson, 2003.
- COSTANZO, L. S. "Physiology". 5th edition. Barcelona: Elsevier Saunders, 2014.
- DVORKIN, M.A. and CARDINALI, D.P. Best & Taylor: Physiological Basis of Medical Practice. 14th edition. México: Ed. Médica Panamericana, 2010.
- FOX, S. I. Human Physiology. 12th edition. Aravaca (Madrid): Ed. McGraw-Hill-Interamericana, 2011.
- GANONG, W. F. Medical Physiology. 24th edition. México: Ed. Mc Graw-Hill, 2013.
- GUYTON, A.C. and HALL, J.E. Tratado de Fisiología Médica. 13ª edición. Madrid: Ed. Elsevier , 2016.
- LEVY B. KOEPPEN M, STANTON BA. Berne Levy Physiology. 6th edition. Madrid: Elsevier Mosby; 2009.
- RHOADES, R. and TANNER, G.A. Medical Physiology. Barcelona: Ed. Masson, 2003.
- SILBERNAGL, S. " Physiology. Text and Atlas ". 7th edition. México. Médica Panamericana, 2008.
- SILVERTHORN, D. U. "Human Physiology. An integrated approach". 6th edition. México. Médica Panamericana, 2014.
- TORTORA, G.J. and DERRICKSON, B. Principles of Anatomy and Physiology. 13th edition. Méjico: Ed. Médica Panamericana. 2013.
- TORTORA, G.J. GRABOWSKAY, S.R., Principles of Anatomy and Physiology. 9th edition. Méjico: Ed. Oxford University Press. 2002.
- TRESGUERRES, J.A.F. et al, Human Physiology. 4th edition. Madrid: Ed. Interamericana-McGraw-Hill, 2014.

Print Journals

- American Journal of Physiology.
- Canadian Journal of Applied Physiology.
- European Journal of Applied Physiology.
- Annual Review of Physiology.
- Handbook of Physiology.
- News in Physiological Reviews.

RECOMMENDED INTERNET LINKS



Electronic Books

- [Origination of Organismal Form: Beyond the Gene in Developmental and Evolutionary Biology/](#) Vienna Series in Theoretical Biology, 2003. (netLibrary)
- [Purkinje's Vision: The Dawning of Neuroscience/](#) Nicholas Wade, Josef Brozek, JirA Hoskovek, 2001. (netLibrary)

Electronic Journals

- [Advances in Physiology Education](#) (DOAJ)
- [American Journal of Physiology](#) (EBSCO Open Access)
- [BMC Physiology](#) (DOAJ)
- [Experimental Physiology \(Cambridge\)](#) (EBSCO Open Access)
- [Journal of Applied Physiology](#) (Free Medical Journals)
- [Nephron – Physiology](#) (Academic Search Premier)
- [Journal of Physiology](#) (Free Medical Journals)
- [The Journal of General Physiology](#) (Free Medical Journal)

PRACTICAL LABORATORY CLASSES

Group work sessions in the laboratory supervised by the lecturer. Meaningful construction of knowledge through interaction and student activity.

The teacher will explain and perform the practice for a small group of students, then the student will practice individually supervised by the teacher and they will complete the various activities proposed in the workbook. At the end of the practices, the student will deliver the notebook with individual results and answers to the questions proposed. This notebook will be corrected by the teacher and returned to the student with the relevant qualification.

TUTORING

Personalized and small group attention. **Continuous instruction and/or orientation carried out by the lecturer** for the purpose of reviewing and discussing the materials and topics presented in lectures, seminars, readings, writing papers and of course to answer questions related with the subject.



ADDITIONAL COMMENTS

CONTEXT WITHIN THE DEGREE

The aim of the teachings of the Degree of Pharmacy is to train experts in drug knowledge and its impact on health, as referred to in the European Directive 85/432 by regulating its teachings. With the study of Human and Cell Physiology (FCH) is intended that the future pharmacist acquire knowledge about the functioning of the human organism. This course is supplemented by Human Physiology II, Pathophysiology (FP), Physiology and Biochemistry Clinics (FBC), Immunology and Human Body Disorders: Functional Testing (AOH), which are discussed in later courses and provides a basis for understanding other basic materials for the pharmaceutical, such as "Pharmacology" and "Pharmacognosy and Phytotherapy", "Clinical Pharmacy and Pharmacotherapy", "Biopharmaceutics and Pharmacokinetics", "Pharmaceutical Technology" and "Nutrition and Food Science." One of the main objectives of the Degree of Pharmacy is the knowledge of different medicines, from research and preparation, dispensing, and knowing potential side effects.

The contents of Cell Physiology and Human subjects are studied on two: FCH I and II, dealing with the study of the various organ systems and their mode of regulation. To facilitate the assimilation of that content from a didactic point of view, we study first the FCH I, cell physiology and large integration systems, nervous and endocrine systems. Then FCH II is focused on different organ systems and the autonomic nervous system, responsible for their regulation along with the endocrine system. However, to maintain the notion that the human body is a functional unit that depends on coordinated functioning and is not the sum of isolated body parts, integrative units such as thermoregulation and general adaptation syndrome are studied at the end of the program.

