

# HUMAN AND CELL PHYSIOLOGY

## ACADEMIC YEAR 2016-17

(aprobada por Consejo de Departamento el 19-enero-2017)

MODULE	CONTENT	YEAR	TERM	CREDITS	TYPE
BASIC COMMON KNOWLEDGE	Physiology	1º	2º	6 ECTS	Basic
<b>LECTURER(S)</b>			<b>Postal address, telephone nº, e-mail address</b>		
Thoretical lectures <ul style="list-style-type: none"> <li>• José L. Quiles Morales</li> <li>• M<sup>a</sup> Dolores Yago Torregrosa</li> <li>• Virginia Aparicio García-Molina</li> <li>• Jerónimo Aragón Vela</li> </ul> Lab and practical classes <ul style="list-style-type: none"> <li>• M<sup>a</sup> Dolores Yago Torregrosa</li> <li>• Virginia Aparicio García-Molina</li> </ul>			Dpt. Physiology, 1st floor, Tel. no 958 243879 Faculty of Pharmacy, Cartuja Campus. <a href="mailto:jlquiles@ugr.es">jlquiles@ugr.es</a> , <a href="mailto:mdyago@ugr.es">mdyago@ugr.es</a> , <a href="mailto:jeroav@ugr.es">jeroav@ugr.es</a> , <a href="mailto:virginiaparcicio@ugr.es">virginiaparcicio@ugr.es</a>		
<b>DEGREE WITHIN WHICH THE SUBJECT IS TAUGHT</b>			<b>TUTORING AND MEETINGS</b>		
Degree in Human Dietetics and Nutrition			<ul style="list-style-type: none"> <li>• José L. Quiles Morales 1st term: Monday 08.30-14.30 2nd term: Monday 09.30-10.30 and 12.30-14.30; Friday 09.30-10.30 and 12.30-14.30</li> <li>• Virginia Aparicio García-Molina Tuesday and Thursday 17.00-19.00 Wednesday 18.00-20.00</li> <li>• M<sup>a</sup> Dolores Yago Torregrosa Tuesday and Thursday 09.30-11.30 Wednesday 10.30-12.30</li> <li>• Jerónimo Aragón Vela Wednesday 9.00-10.30</li> </ul>		
<b>PREREQUISITES and/or RECOMMENDATIONS (if necessary)</b>					
Prerequisites: those necessary to access to the Degree, related with the level of formation that the student must acquire to accede to the University. Recommendations: to have previous basic knowledge (background knowledge) of Biology, Human Anatomy and Histology, and Chemistry. A good standard of English and informatics skills are also required.					
<b>BRIEF ACCOUNT OF THE SUBJECT PROGRAMME</b>					



- Introduction to General and Cell Physiology (excitability: nerve and muscle cells; synaptic transmission)
- Function of organic systems: nervous system (nervous system -NS- organization; sensory physiology; autonomic NS -peripheral and central-; superior functions of the NS and food intake regulation), digestive system and endocrine system.

## GENERAL AND PARTICULAR ABILITIES

### GENERAL ABILITIES

- CG2** To develop the profession as for other professionals of the health, acquiring skills to be employed at team
- CG3** To recognize the need to support and update the professional competence, giving special importance to the learning, of an autonomous and continued way, of new knowledge, products and skills in nutrition and food, as well as to the motivation for the quality
- CG4** To know the limits of the profession and their competences, identifying, when a treatment is necessary to interdiscipline or the derivation to another professional
- CG5** To realize the communication of an effective way, so much of oral such as written form, with the persons, the professionals of the health or the industry and the mass media, being able to use the technologies of the information and the communication specially the related ones to nutrition and habits of life
- CG29** To acquire the basic training for the investigative activity, being capable of formulating hypothesis, gathering and interpreting the information for the resolution of problems following the scientific method, and understanding the importance and the limitations of the scientific thought in sanitary and nutritional matter.

### SPECIFIC ABILITIES

- CE1** To know the chemical, biochemical and biological foundations of application in human and dietetic nutrition
- CE2** To know the structure and function of the human body from the molecular level to the complete organism, in the different stages of the life
- CE26** To know the nutrients, their functions and their metabolic utilization. To know the bases of the nutritional balance and their regulation

## DETAILED SUBJECT TOPICS

### Thematic Unit 1. - Introduction to Physiology (1h\*).

- ▶ To define the concepts of Physiology, internal environment and homeostasis.
- ▶ To know the interest of Human and Cell Physiology for a graduate in Nutrition.

### Thematic Unit 2. - Excitability (3h).

- ▶ To describe and explain the resting membrane potential and its ionic bases.
- ▶ To describe the local potentials and ion channels involved.
- ▶ To describe and explain the phases, properties and ionic basis of the action potential.
- ▶ To know excitability changes along the action potential.
- ▶ To describe the action potential conduction and the effect of myelin on it.

### Thematic Unit 3. - Nerve cells (1h).

- ▶ To study the functions of the neuron.
- ▶ To describe the process of myelinogenesis.
- ▶ To know the properties of the neuron.
- ▶ To describe the events involved in the injury and regeneration of peripheral nerves.

### Thematic Unit 4. - Synaptic transmission (2h).

- ▶ To describe the main morphological characteristics of the synapse.
- ▶ To distinguish between electrical and chemical synapses.
- ▶ To list the steps used in the transmission of impulses across the synapse.
- ▶ To distinguish between excitatory and inhibitory postsynaptic potentials.



- ▶ To define presynaptic inhibition.
- ▶ To identify the different types of neural circuits in the nervous system.
- ▶ To difference between spatial and temporal summation.
- ▶ To describe the properties of the synapse.
- ▶ To list the criteria for identifying a substance as a neurotransmitter.
- ▶ To describe the classification and functions of neurotransmitters.
- ▶ To define and classify the neuromodulators.

**Thematic Unit 5. - General concepts of the physiology of the muscular fibers (0.5h).**

- ▶ To explain the functional differences between skeletal, cardiac and smooth muscle.
- ▶ To explain the general concepts of the neuromuscular junction.

**Thematic Unit 6. - Structure of the nervous system (1.5 h).**

- ▶ To study the basic functions of the nervous system.
- ▶ To know the functional characteristics of the cranial and spinal nerves.
- ▶ To understand the elements involved in the protection of the central nervous system.
- ▶ To explain the formation, movement and function of cerebrospinal fluid.
- ▶ To know the meaning of the blood brain barrier.

**Thematic Unit 7.- General principles of sensory physiology (1.5h).**

- ▶ To differentiate the concepts of sensation and perception.
- ▶ To enumerate the types of sensory modalities.
- ▶ To define and to classify the sensory receptors.
- ▶ To describe the process of sensory transduction and to differ between generator potential and receptor potential.
- ▶ To differ between slowly- and rapidly-adapting receptors.
- ▶ To define the concept of receptive field.
- ▶ To describe the process of sensory codification.

**Thematic Unit 8. Physiology of the taste (1h)**

- ▶ To know the structure of the gustatory receptors
- ▶ To describe the physiology of the taste.
- ▶ To describe the routes and centers for gustatory sensibility.

**Thematic Unit 9. Physiology of the smell (1h)**

- ▶ To know the structure of the olfactory receptors.
- ▶ To describe the physiology of the smell.
- ▶ To describe the routes and centers for olfactory sensibility.

**Thematic Unit 10.- Introduction to the somatovisceral sensibility (0.5 h)**

- ▶ To describe briefly the physiology of receptors for tactile, temperature and pain sensations.
- ▶ To describe the different types of pain.

**Thematic Unit 11. Introduction to the physiology of vision (0.5 h)**

- ▶ To describe brief the physiology of vision.
- ▶ To explain the role of refraction, accommodation and constriction in the formation of images.
- ▶ To describe the functions of the photoreceptors and photopigments.
- ▶ To know photoreceptor light- and dark-adaptation.

**Thematic Unit 12. Introduction to the physiology of hearing and balance (0.5 h)**

- ▶ To describe briefly the physiology of hearing.
- ▶ To describe the characteristics of a sound wave.
- ▶ To describe the codification of frequency, intensity and location of the sound.
- ▶ To describe briefly the physiology of balance.
- ▶ To describe the function of the maculae in static and dynamic balance (acceleration and linear deceleration).
- ▶ To describe the function of the ampullary crista in rotational acceleration and deceleration.

**Thematic Unit 13. – Peripheral organization of autonomic nervous system. (1.5 h)**

- ▶ Compare the autonomic and somatic nervous systems.
- ▶ Describe functionally preganglionic and postganglionic neurons of the autonomic nervous system.
- ▶ Describe the organization and synaptic transmission in the sympathetic and parasympathetic nervous systems.
- ▶ Indicate the neurotransmitters and receptors of the sympathetic and parasympathetic systems and exceptions.



- ▶ List the physiological effects of the autonomic nervous system.

**Thematic Unit 14. - Central organization of the autonomic nervous system. (1 h)**

- ▶ To explain the functional relationship of the hypothalamus to the autonomic nervous system.
- ▶ To explain the mechanisms that regulate the intake of water.

**Thematic Unit 15.- Nervous system and control of the ingestion and other superior functions (1h)**

- ▶ To explain the physiological bases of the food conduct: Mechanisms that regulate food intake. Role of orexigenic and anorexigenic peptides, and other peripheral factors involved.
- ▶ To explain briefly other superior functions of the nervous system: sleep-wake cycle, learning and memory.

**Thematic Unit 16. Functional structure of the digestive tract. Smooth muscle. Digestive motility (2h)**

- ▶ To identify the gastrointestinal organs.
- ▶ To describe the layers in the wall of the digestive tract.
- ▶ To describe the general functions of the digestive system.
- ▶ To describe the mechanism of contraction and the properties of the smooth muscle.
- ▶ To explain the mechanisms of swallowing.
- ▶ To enumerate the factors that regulate gastric emptying.
- ▶ To enumerate the different intestinal motility patterns and to describe their functions.
- ▶ To explain the mechanisms involved in the defecation reflex.

**Thematic Unit 17. Composition, function and regulation of the salivary and gastric secretion (1.5h)**

- ▶ To describe the composition, function and regulation of the salivary secretion.
- ▶ To describe the composition, function and regulation of the gastric secretion.

**Thematic Unit 18. Composition, function and regulation of the pancreatic secretion (1h)**

- ▶ To describe the composition, function and regulation of the exocrine pancreatic secretion.

**Thematic Unit 19. Composition, function and regulation of the biliary and intestinal secretions (1.5h)**

- ▶ To explain the functional organization of the hepatic lobule.
- ▶ To describe the composition, function and regulation of bile secretion.
- ▶ To explain the enterohepatic circulation.
- ▶ To explain the functional organization of the intestinal villi.
- ▶ To describe the composition, function and regulation of the intestinal secretions.

**Thematic Unit 20. Digestion and absorption (2h)**

- ▶ To know the basic principles of the gastrointestinal absorption.
- ▶ To describe the digestion and absorption of carbohydrates.
- ▶ To describe the digestion and absorption of proteins.
- ▶ To describe the digestion and absorption of fats.
- ▶ To explain the absorption of water and electrolytes.
- ▶ To explain absorption of vitamins.

**Thematic Unit 21. General organization of the endocrine system and neuroendocrine integration (1.5h)**

- ▶ To define the terms of hormone and endocrine gland.
- ▶ To identify the different endocrine glands and the hormones secreted.
- ▶ To enumerate the criteria that identify a substance as hormone.
- ▶ To know the classification of the different hormones.
- ▶ To know the processes of synthesis, secretion, transport and metabolism of hormones.
- ▶ To describe the mechanisms that control hormone secretion.
- ▶ To describe the general mechanisms of hormone action.
- ▶ To explain the functional relation between the hypothalamus and the hypophysis.
- ▶ To describe the functional implications of the hypothalamus-hypophysis portal system.
- ▶ To enumerate the hormones of the neuro- and adeno-hypophysis and, for the latter, to explain its regulation by the hypothalamus.

**Thematic Unit 22. Physiology of the thyroid (1h)**

- ▶ To know the thyroid hormones.
- ▶ To describe the biological actions of thyroid hormones and the regulation of their secretion.

**Thematic Unit 23. Hormonal regulation of growth (1h)**



- ▶ To describe the metabolic effects and the regulation of growth hormone (GH) secretion.
- ▶ To know other factors and hormones involved in growth.

#### **Thematic Unit 24. Hormonal regulation of the metabolism calcium /phosphorus (1h)**

- ▶ To know the different types of bone cells.
- ▶ To describe the interaction between the plasma levels of calcium, parathyroid hormone and calcitonin.
- ▶ To describe the biological actions and the regulation of the secretion of parathyroid hormone, 1,25-diOH-vitamin D and calcitonin.

#### **Thematic Unit 25. Physiology of the endocrine pancreas (1h)**

- ▶ To describe the principal metabolic actions of insulin and glucagon and to explain the regulation of their secretion.

#### **Thematic Unit 26. Physiology of the adrenal gland (1h)**

- ▶ To describe the principal biological actions of cortisol.
- ▶ To describe the hypothalamic-pituitary-adrenal axis in the control of the secretion of glucocorticoids.
- ▶ To describe the actions of the catecholamines and to explain how the secretion of the adrenal medulla is regulated.

#### **Thematic Unit 27. Hormonal regulation of ion and water balance. (1h)**

- ▶ To know the paper of mineralocorticoids in the regulation of water and electrolyte homeostasis.
- ▶ To describe the main biological actions of aldosterone.
- ▶ To describe the biological actions of ADH and how its secretion is regulated.
- ▶ To describe the renin-angiotensin-aldosterone system, its mechanism of activation and its functions.

## **Practical Program**

**Practice 1.** - Functional anatomy of human body.

**Practice 2.** - Gustatory and olfactory receptors.

**Practice 3.** - Endocrine system. Effect of thyroxine, TSH and propiltiouracile on basal metabolism.

**Practice 4.** - Determination of the glycemic profile.

**Practice 5.** - Physico-chemical processes of digestion.

**Practice 6.** - Measurement of intestinal glucose absorption in vivo: Intestinal perfusion.

Practical and written exam

## **Seminars**

## **Exam**

### **SYSTEM FOR ASSESSING THE ACQUISITION OF COMPETENCES AND KNOWLEDGE/EVALUATION CRITERIA**

#### **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

### GENERAL

#### Textbooks:

- Cordova A. "Fisiología dinámica". Masson, 2003.
- Costanzo, L. S. "Fisiología". 5ª edición. Barcelona: Elsevier Saunders, 2014.
- Drucker Colin R. "Fisiología médica". El Manual Moderno, 2006.
- Dvorkin MA, Cardinali DP, Lermoli R. "Best & Taylor: Bases fisiológicas de la práctica médica". 14ª ed. Editorial Médica Panamericana, 2010.
- Fox SI. "Fisiología humana". 12ª ed. McGraw-Hill-Interamericana, 2011.



- Barrett KE. "Ganong Fisiología médica". 23ª ed. McGraw-Hill, 2010.
- Hall JE. "Guyton & Hall Tratado de Fisiología médica". 13ª ed. Elsevier, 2016.
- Hall JE. "Guyton & Hall Compendio de Fisiología médica". 13ª ed. Elsevier, 2016.
- Hall JE. "Guyton & Hall Repaso de Fisiología". 3ª ed. Elsevier, 2016.
- Koeppen BM, Stanton BA. "Berne y Levy Fisiología". 6ª ed. Elsevier-Mosby, 2009.
- Martín Cuenca E. "Fundamentos de Fisiología". Thompson, 2006.
- Pocock G, Richards CD. "Fisiología humana. La base de la Medicina". 2ª ed. Masson, 2005.
- Preston R.B., Wilson T.E. "Fisiología". Series Editor: Harvey Richard A. Lippincott's Illustrated Reviews. Barcelona: Lippincott Williams & Wilkins. 2013.
- Rhoades RA, Bell DR. "Medical Physiology". Lippincott Williams-Wilkins, 2009.
- Silbernagl S, Despopoulos A. "Fisiología. Texto y atlas". 7ª ed. Editorial Médica Panamericana, 2008.
- Silverthorn DU. "Fisiología humana", 6ª ed. Editorial Médica Panamericana, 2014.
- Stanfield CL. "Principios de Fisiología Humana", 4ª ed. Pearson, 2011.
- Thibodeau GA, Patton KT. "Estructura y función del cuerpo humano". 13ª ed. Elsevier, 2008.
- Tortora GJ, Derrickson B. "Principios de Anatomía y Fisiología". 13ª ed. Editorial Médica Panamericana, 2013.
- Tresguerres JAF y otros. "Fisiología humana". 4ª ed. Interamericana-McGraw-Hill, 2010.
- Tresguerres JAF, López-Calderón A, Villanúa MA. "Anatomía y Fisiología del cuerpo humano". 1ª ed. McGraw-Hill, 2009.

#### Dictionaries and atlases:

- Diccionario médico. Marban, 2005.
- Diccionario médico de bolsillo. Marban, 2005.
- Junqueira LC, Carneiro J. "Histología básica. Texto y atlas". 6ª ed. Masson, 2005.
- Netter, FH. "Atlas de Anatomía Humana". 3ª ed. Masson, 2005.

#### **SPECIFIC**

- Alberts B. "Introducción a la Biología celular". 2ª ed. Editorial Médica Panamericana, 2006.
- Bear MF y otros. "Neurociencia. Explorando el cerebro". 3ª ed. Masson-Williams, 2008.
- Cursos CRASH. "Lo esencial en sistema nervioso y sentidos especiales". 2ª ed. Mosby, 2004.
- Cursos CRASH. "Lo esencial en sistema músculo-esquelético". 2ª ed. Mosby, 2004.
- Cursos CRASH. "Lo esencial en aparato cardiovascular". Mosby, 2004.
- Cursos CRASH. "Lo esencial en aparato respiratorio". 2ª ed. Mosby, 2004.
- Cursos CRASH. "Lo esencial en aparato digestivo". Mosby, 2004.
- Eaton DC. "Fisiología renal de Vander". 6ª ed. McGraw Hill Interamericana, 2006.
- West JB. "Fisiología respiratoria". 8ª ed. Lippincott Williams & Wilkins, 2009.
- Williams WJ. "Hematología". Marban, 2005.

#### **PERIODICAL PUBLICATIONS (JOURNALS)**

- Annual Review of Physiology



- Current Advances in Physiology
- News in Physiological Sciences
- Physiological Reviews

### **LAB MANUALS**

- Amitrano R, Tortora G. "Anatomy & Physiology Laboratory Manual". 7ª ed. Brooks Cole, 2006.
- Ayús JC, Caramelo C, Tejedor A. "Agua, electrolitos y equilibrio ácido-base. Aprendizaje mediante casos clínicos". Editorial Médica Panamericana, 2006.
- Casas A, Salve ML, Amich S, Prieto S. "Laboratorio clínico. Hematología". McGraw-Hill Interamericana, 1994.
- IUPS (International Union of Physiological Sciences. Commission on Teaching Physiology). A source book of practical experiments in physiology requiring minimal equipment. World Scientific, 1991.
- Marieb EN, Mitchell SJ. "Human Anatomy and Physiology Lab Manual", 8ª ed. Benjamin Cummings, 2007.
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- Suckow MA, Weisbroth SH, Franklin CL. "The laboratory rat". Academic Press, 2006.
- Varios. Cuaderno de Prácticas de Fisiología Celular y Humana. Departamento de Fisiología. Facultad de Farmacia. Universidad de Granada. 2005.

### **COMPUTER SIMULATIONS**

- Stabler T y otros. PhysioEx 6.0 para fisiología humana. Simulaciones de laboratorio de Fisiología. Pearson. Addison Wesley, 2006.

### **RECOMMENDED INTERNET LINKS**

#### **WEB RESOURCES**

- [http://www.nlm.nih.gov/research/visible/visible\\_human.html](http://www.nlm.nih.gov/research/visible/visible_human.html) Visible human project
- <http://muscle.ucsd.edu/musintro/Jump.shtml> Fisiología del músculo esquelético
- <http://www.vivo.colostate.edu/hbooks/pathphys/digestion/> Fisiología digestiva
- <http://www.tiroides.net> Página web de información y ayuda al paciente tiroideo
- <http://neuroscience.uth.tmc.edu/index.htm> Plataforma online e interactiva para el estudio de neurofisiología

#### **SCIENTIFIC SOCIETIES**

- <http://www.the-aps.org/> The American Physiological Society
- <http://physoc.org/> The Physiological Society
- <http://www.secf.es/> Sociedad Española de Ciencias Fisiológicas
- <http://www.feps.org/> Federación Europea de Sociedades de Fisiología

