

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

Code	33148
Name	Human physiology
Cycle	Grade
ECTS Credits	7.5
Academic year	2021 - 2022

Study (s)

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

Subject-matter

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

Coordination

Name	Department
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. THE CONTROL OF BODY MOVEMENT. Neural reflexes.- Autonomic reflexes.- Skeletal muscle reflexes.- The 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 osmolarity.

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

Laboratory exercises

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.



Simulation exercises

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

Three sessions will be planned throughout the course, each lasting an hour (face-to-face or by videoconference), 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
TOTAL	187,50	

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 8 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 3 **1-hour Tutorial sessions**, 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 **theory evaluation** will be carried out in a test that will contain questions of different types (reasoning, definitions, schemes, true and false and why, etc ...) and multiple choice questions (a minimum of 50).

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%)

Theory exam questions	40 points
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Test questionnaires	20 points
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PRACTICES (30%)

Practical cases	20 points
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Laboratory practice simulation questionnaire	10 points
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OTHER ACTIVITIES (5%)



Assistance and use of tutoring and problems	2,5 points
Virtual classroom questionnaires	2,5 points
JOURNAL CLUB ACTIVITY (5%)	
Journal Club	5 points
TOTAL	100 POINTS

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.

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

1 y 2) Contenidos y Volumen de trabajo.

Se mantendrán los contenidos inicialmente programados en la guía docente para las sesiones teóricas.

En el caso de las prácticas, si fuese necesario por la situación sanitaria, se sustituirán las prácticas presenciales de laboratorio que no puedan llevarse a cabo por clases prácticas de simulación.

Los contenidos de las actividades tutoriales, problemas en aula y actividades de evaluación continua se mantendrán en sus contenidos originales.

El volumen de trabajo no cambia. Las actividades a realizar son básicamente las especificadas en la guía de la asignatura. Se mantiene la programación temporal de materiales docentes puestos a disposición del alumnado, de acuerdo con el calendario académico. En caso necesario se modificará la planificación temporal según las condiciones sanitarias.

3) Metodología.

El punto de inicio dado el número de estudiantes y las aulas disponibles es de presencialidad del 50% en clases de teoría con retransmisión síncrona y plena presencialidad en el resto de las actividades. Sin embargo, ante la posibilidad de que la evolución de la situación derivada de la COVID-19 obligue a una reducción de la presencialidad, se tomarán las siguientes medidas:

1) Las actividades presenciales en aula se sustituirían en función de las herramientas tecnológicas disponibles en el aula en el momento de desarrollo del curso, por las siguientes metodologías:

- Videoconferencia síncrona



- Videos de presentaciones en mmedia.uv.es
- Presentaciones Powerpoint locutadas en Aula Virtual
- Presentaciones Powerpoint con apuntes extendidos en Aula Virtual
- Propuestas de entrega de tareas y cuestiones por Aula Virtual, realización de lecciones en aula virtual, etc...

2) Las actividades presenciales de prácticas, si fuese necesario por la situación sanitaria, se sustituirán por clases prácticas de simulación a distancia.

3) Para tutorías y dudas se utilizarían las siguientes metodologías:

- Se podrán emplear medios como “Blackboard” (o similar) para tutorías individuales o grupales para resolver dudas o cuestiones.
- Chats síncronos en Aula Virtual
- Foros asíncronos en Aula Virtual
- Comunicación directa profesor-estudiante a través del correo institucional

4) Evaluación.

Se mantendrá la ponderación de los distintos bloques de evaluación, a excepción de la ponderación de los test de prácticas de simulación (dentro del examen de prácticas) que se corregirán en proporción al número de prácticas de simulación que sea necesario añadir.

En caso de que los exámenes no pudieran ser presenciales, se realizarían ‘on line’ en Aula Virtual mediante las herramientas disponibles.

Los detalles concretos de la adaptación a las situaciones que se pudieran producir se supervisarán por la CAT y se comunicaran a los estudiantes a través de Aula Virtual.

Si por causas técnicas, debidamente justificadas, algún estudiante no pudiera realizar alguna actividad, se estudiará la posibilidad de realizar una prueba alternativa que, en todo caso, será de tipo oral.