

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

Code	34449
Name	General physiology
Cycle	Grade
ECTS Credits	6.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1204 - Degree in Medicine	Faculty of Medicine and Odontology	1	First term

Subject-matter

Degree	Subject-matter	Character
1204 - Degree in Medicine	5 - Physiology	Basic Training

Coordination

Name	Department
MEDINA BESO, PASCUAL	190 - Physiology

SUMMARY

The subject of General Physiology seeks to achieve that the future professional of the Medicine acquires the basic notions about the functioning of the cells of the human organism and their mechanisms of environment adaptation. This will be achieved through a biological approach of the posed issues and by the exposition and handling of basic cell models with special attention to the nervous communication and regulation systems in general.

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

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



Other requirements

OUTCOMES

1204 - Degree in Medicine

- Understand and recognise the structure and normal function of the human body, at the following levels: molecular, tissue, organic, and of systems, in each phase of human life and in both sexes.
- Understand and recognise the effects of growth, development and aging which affect individuals and their social environment.
- Know how to use the sources of clinical and biomedical information available, and value them critically in order to obtain, organise, interpret and communicate scientific and sanitary information.
- Know how to use IT in clinical, therapeutic and preventive activities, and those of research.
- In the professional practise, take a point of view which is critical, creative, constructive and research-oriented.
- Be able to formulate hypothesis, gather information and evaluate it critically in order to solve problems by following the scientific method.
- Establish a good interpersonal communication which may allow professionals show empathy and talk to the patients efficiently, as well as to their relatives, the media and other professionals.
- Proper organisation and planning of the workload and timing in professional activities.
- Team-working skills and engaging with other people in the same line of work or different.
- Criticism and self-criticism skills.
- Capacity for communicating with professional circles from other domains.
- Acknowledge diversity and multiculturality.
- Consideration of ethics as a fundamental value in the professional practise.
- Working capacity to function in an international context.
- Knows the cell structure and its function. Implication of biomolecules. Knows the metabolism, its regulation and metabolic integration.
- Knows the procedures in cell communication and the function of excitable cell membranes.
- Knows the morphology, structure and function of skin, blood, organs and body systems: circulatory, digestive, locomotor, reproductive, excretory and respiratory systems; endocrine system, immune system, central and peripheral nervous systems.
- Knows the processes of growth, maturation and aging of the different organs and systems. Homeostasis. Adaptation to the environment.
- Handles material and the use of basic laboratory techniques.
- Knows how to carry out functional tests, determines vital parameters and interprets them.



LEARNING OUTCOMES

Once the complete subject is cursred students must be able to:

- Understand the mechanisms of regulation of the organism.
- Understand the functioning of the nerve cells, their properties and their regulation.
- Understand the functioning of the central and peripheral synapses.
- Understand the coupling, excitation and contraction in the different kinds of muscles.
- Understand the mechanisms of cell secretion and their regulation systems.

DESCRIPTION OF CONTENTS

1. HOMEOSTASIS AND CELL PHYSIOLOGY

LESSON 1: INTRODUCTION TO THE STUDY OF PHYSIOLOGY. What is Physiology? Physiology levels: molecular physiology, cell physiology, systems physiology, integrative physiology.

LESSON 2: INTERNAL ENVIRONMENT AND HOMEOSTASIS. Internal environment. Homeostasis and feed-back mechanisms

LESSON 3: HYDROELECTROLYTIC EQUILIBRIUM. Water: Amount, functions and distribution. Liquid compartments. Classification. Composition and functions. Methods for they quantification.

LESSON 4: CELL MEMBRANES. MECHANISMS OF TRANSPORT IN CELL MEMBRANES. Transport mechanisms in cellular membranes. General characteristics. Functional significance.

LESSON 5: IONIC CHANNELS. Type of ionic channels. Channels operated by ligands. Biophysical and molecular properties. Channels operated by membrane potential. Classification. Biophysical and molecular properties.

LESSON 6: INTERCELLULAR COMUNICATION. Types of intercellular communication. Communication molecules: types and characteristics.

2. HOMEOSTASIS AND CELL PHYSIOLOGY (continuation)

LESSON 7: INTRACELLULAR SIGNALING. Signal transduction. G proteins. Second messengers.

LESSON 8: INTRODUCTION TO THE STUDY OF EXCITABLE CELLS. NEURONS AND MUSCULAR CELLS. Cells of the neuron tissue. Neurons and glial cells. Types of muscular cells.

LESSON 9: PROPERTIES OF THE RESTING MEMBRANE. Electric characteristics of resting membrane. Membrane potential: Concept and generation. Bioelectric analysis of the resting membrane: Goldman's equation. Role of active transport.

LESSON 10: ACTION POTENTIAL. The action potential. Phases of depolarization and repolarization. Ionic Analysis. Propagation and conduction of the action potential.

LESSON 11: CONDUCTION OF ACTION POTENTIAL. Mechanisms of action potential conduction. Unmyelinated fibers. Myelinated fibers: saltatory conduction.



LESSON 12: FUNCTIONAL CHARACTERISTICS OF THE NERVE FIBERS. Classification of nerve fibers. Axonal transport. Nervous degeneration and regeneration.

LESSON 13: INTRODUCTION TO NERVOUS SYSTEM. Introduction to the study of the general mechanisms of central and peripheral regulation.

LESSON 14: AUTONOMIC NERVOUS SYSTEM. Sympathetic nervous system and parasympathetic nervous system.

3. PHYSIOLOGY OF SYNAPTIC TRANSMISSION

LESSON 15: INTRODUCTION TO THE STUDY OF SYNAPSES. ELECTRIC SYNAPSES. Morphofunctional organization. Classification. Electric synapses.

LESSON 16: GENERAL CHARACTERISTICS OF CHEMICAL SYNAPSES. Neurotransmitters and types. Synthesis, release, reuptake and metabolism of neurotransmitters. Post-synaptic potentials and synaptic integration.

LESSON 17: CHOLINERGIC SYNAPSES. Synthesis of the cholinergic neurotransmitter. Acetylcholine receptors. Neuromuscular junction as a model of cholinergic synapse.

LESSON 18: CATHECOLAMINERGIC SYNAPSES. Synthesis of the catecholaminergic neurotransmitter. Adrenergic receptors. Up-take and degradation of neurotransmitters.

LESSON 19: SEROTONINERGIC AND HISTAMINERGIC SYNAPSES. Synthesis of neurotransmitters. Classification of neurotransmitters. Up-take and degradation of neurotransmitters. Functions.

LESSON 20: GLUTAMATERGIC SYNAPSES. Synthesis of neurotransmitters. Classification of neurotransmitters. Up-take and degradation of neurotransmitters. Functions.

LESSON 21: GABAERGIC AND GLYCINERGIC SYNAPSES. Synthesis of neurotransmitters. Classification of neurotransmitters. Up-take and degradation of neurotransmitters. Functions.

LESSON 22: PEPTIDERGIC AND PURINERGIC SYNAPSES. Synthesis of neurotransmitters. Classification of neurotransmitters. Up-take and degradation of neurotransmitters. Functions.

LESSON 23: NONCANNONICAL NEUROTRANSMITTERS. Cannabinoids. Other neurotransmitters, transcellular mediators. Nitric Oxide.

4. PHYSIOLOGY OF MUSCLE CONTRACTION

LESSON 24: PROPERTIES OF MUSCLES. SKELETIC MUSCLE CONTRACTION. Electric phenomena in muscle. Muscle contraction process. Muscle relaxation. Energy consumption during muscle contraction and relaxation.

LESSON 25: MUSCLE MECHANICS AND ELECTROPHYSIOLOGY. Types of contraction. And method for its study. Strength transmission. Correspondence between structure and function in muscle fibers. Relation: muscle length to active tension and strength velocity. Summation and tetanization. Posttetanic potentiation. The staircase effect (Treppe). Motor unit. The electromyogram (EMG).

LESSON 26: PHYSIOLOGY OF CARDIAC MUSCLE. Importance of cardiac muscle. Types. Electric activity, genesis of pacemaker potentials. The myocardial contraction mechanism. Metabolism of the cardiac muscle.

LESSON 27: PHYSIOLOGY OF SMOOTH MUSCLE. Types of smooth muscle. Electric activity. Neuromuscular junctions. The process of contraction. Characteristics of smooth muscle contraction.



5. PHYSIOLOGY OF THE GENERAL REGULATORY SYSTEMS

LESSON 28: PHYSIOLOGY OF SENSITIVITY: SENSORY RECEPTOR. Types of sensitivity. Sensory stimuli. Codification of sensory information. Transmission of sensory signals by nervous fibers. The sensory receptor. Types of receptors. Classification criteria.

LESSON 29: GENERAL MECHANISMS OF SECRETION. Secretion of macromolecules. Formation of secretory vesicles. Electrophysiology of secretory cells and excitation-secretion coupling.

LESSON 30: GENERAL MECHANISMS OF REGULATION. INTRODUCTION TO ENDOCRINE SYSTEM. Hormones transport. Hormone receptors. Classification. Mechanisms of action. Mechanisms of regulation.

6. PRACTICAL SESSIONS

LABORATORY PRACTICAL SESSIONS

1. Body fluids and osmotic pressure.
2. Ionic channels and patch-clamp.
3. Checking of the Nernst's equation.
4. Neuronal excitability. Intensity-time curve. Calculation of the rheobase and chronaxie. Absolute and relative refractory periods
5. Action potential. Accommodation phenomena. Conduction of the potential. Types of nerve fibres.
6. Muscular and nerve action potentials. Electromyography.
7. Determination of the speed of nerve conduction.
8. Synapsis. Synaptic integration. Synaptic fatigue.
9. Skeletal muscle contraction characteristics.
10. Smooth muscle contraction characteristics.
11. Sensory receptor potential.

TUTORIAL GROUPS

Presentation of a collaborative work.



WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	33,00	100
Laboratory practices	23,00	100
Tutorials	4,00	100
Development of group work	5,00	0
Study and independent work	50,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	10,00	0
Preparing lectures	10,00	0
Preparation of practical classes and problem	10,00	0
TOTAL	150,00	

TEACHING METHODOLOGY

Theoretical Lessons: the theoretical units will be taught in master classes, supported by complementary material accessible through Aula Virtual, usually available prior to class.

Laboratory Practical Lessons: the theoretical units will be developed in teaching laboratories. They include experimental determination of physiological magnitudes, simulations, interactive models, practices with teaching innovative technologies, registers about the functional parameters of the students, as well as the calculation of variables and their physiological interpretation. In some cases, students have the complementary material in the Aula Virtual.

Tutorials groups: in the sessions of tutored groups, students develop several activities, depending on their degree of formation and interests among the different modalities of works: topics to be developed, clinical cases, etc. In every case, the oral presentation of the work is highlighted.

The gender perspective and the sustainable development goals (SDGs) will be incorporated into teaching, whenever possible.

EVALUATION

Theoretical assessment: 60% of the final mark (6 points). It will be made by written test about the content on the theoretical program and it will have as the main goal to assess the acquisition of knowledge. The content of the test will be the same for each group of the same subject, and will consist on 6 questions of a limited length (about half a page), 1 point each question.



Practical assessment: 40% of the final mark (4 points). It will be calculated as:

- A test that assesses the acquisition of skills related with the general and specific competencies (2 points). It will be evaluated together with the written test of the theoretical lessons, and will consist of 10 multiple choice questions (1/5 options). Each correct question is worth 0.2 points, 0.05 points will be subtracted for each incorrect answer; and for blank answers there is no penalty.
- Continuous assessment of the participation in the different practical activities (1 point). It will be evaluated based on the skills acquired during the attendance to practical sessions, and on the submission of the tasks performed during the sessions, either in physical form or through the virtual class.
- Work performed in the tutorial groups (1 point).

The subject will be passed with a mark equal or superior to 5 with a minimum of 3 in the theoretical part and 2 in the practical one.

Attendance to practical sessions is mandatory. Unjustified non-attendance to more than 20% of the sessions will make impossible to pass the course.

Students are reminded of the importance of carrying out evaluation surveys on all the teaching staff of the degree subjects.

REFERENCES

Basic

- Cellular Physiology and Neurophysiology. Mordecai Blaustein, Joseph K.D. Matteson. 3^a Ed. Mosby Physiology Series. 2019. Editorial Elsevier. ISBN: 9780323596190.
- Berne y Levi. Fisiología. Bruce M. Koeppen, Bruce A. Stanton. 17^a Ed. 2018. Editorial Elsevier. ISBN: 9788491132585.
- Fisiología Humana. Un enfoque integrado. Dee Unglaub Silverthorn. 8^a Ed. 2019. Editorial Panamericana. ISBN: 9786078546220.
- RECURSOS e-Salut: ClinicalKey Student. Elsevier (Scopus, ScienceDirect). [uv-es.libguides.com/RecursosSalut/BibliotecaSalut].

Additional

- Fisiología Humana. Stuart Ira Fox. 14^a Ed. 2016. Editorial McGraw-Hill Interamericana. ISBN: 9786071514134.
- Guyton & Hall. Tratado de fisiología médica. John E. Hall. 14^a Ed. 2021. Editorial Elsevier. ISBN: 9788413820132.
- Fisiología Humana. Fernández-Tresguerres J.A. et al. 5^a Ed. 2020. Editorial: McGraw-Hill Interamericana. ISBN: 9786071503497.



- Principles of Neural Science. Kandel Eric R., Koester John D., Mack Sarah H., Siegelbaum Steven. 6^a Ed. 2021. Editorial McGraw-Hill. ISBN: 9781259642234.

