

OPR078 physiology

1. LANGUAGE

Italian

2. COURSE CONTENTS

Coordinator: **Prof. Guido Maria Filippi**

Anno di corso: 2022/2023 (II anno)

Semestre: 1°

CFU: 11

Module and Teachers:

- General physiology - Prof. Guido Maria Filippi – 8 cfu
- Special physiology - Prof. Guido Maria Filippi – 3 cfu

3. BIBLIOGRAPHY

Recommended handbooks - General physiology:

- FONDAMENTI DI FISILOGIA UMANA Lauree Sherwood
- FISILOGIA Berne Levy Koeppen Stanton - FISILOGIA D'Angelo e Peres Ed. Edi-ermes
- FISILOGIA UMANA FONDAMENTI Anna Belfiore, Chiara Berteotti, e al Ed EdiSES

Recommended handbooks - Special physiology

- FISILOGIA ORALE E DELL'APPARATO STOMATOGNATICO. D. Manzoni e E.Scarnati. Ed edi-ermes

4. LEARNING OBJECTIVES

Teaching intends to provide students with an integrated view of the functioning of the human body of the main regulatory systems and their interactions.

The teaching is aimed at developing the understanding of functioning mechanisms and emphasizes the recognition of cause-and-effect relationships in the events that underlie physiological functions. The teaching also wants to offer the knowledge of the integration with the other teachings: it has its roots in the preparatory courses of physics, chemistry and anatomy and offers the basis for subsequent courses in pathology and clinical character, with special reference to dental problems.

- **Knowledge and understanding** - The student must demonstrate knowledge and understanding of the vital functions of man, the molecular and cellular mechanisms underlying the functioning of the various organs and systems and the main processes of integration, regulation and homeostatic control
- **Applied knowledge and understanding** - The student must demonstrate that he knows how to adequately interpret and understand the possible applications of the acquired knowledge, highlighting its implications in the clinical setting. The student must also demonstrate that he is able to perform instrumental investigations for the evaluation of physiological parameters that are the subject of the professionalizing activity and that he has understood the principles underlying these methods.
- **Autonomy of judgment** - The student must develop autonomous skills in understanding the functional integrations between the different systems in physiological conditions and predict the

body's responses to perturbations.

Communication skills - The student must be able to describe physiological processes using technical language correctly and must communicate his knowledge in a clear and unambiguous way to specialist and non-specialist interlocutors.

• **Ability to learn** - The student must be able to self-evaluate their skills, to broaden their knowledge and to update themselves by independently drawing on texts, scientific articles and online platforms.

5. PREREQUISITES

The student must have knowledge of basic scientific subjects, especially biochemistry, physics, biology and anatomy.

6. TEACHING METHODS

The teaching of the course is mainly divided into lectures. The topics covered in the program will be presented in a context that prepares students for their role as physicians. Therefore, when possible, clinical examples will be used to illustrate basic physiological principles.

7. OTHER INFORMATIONS

8. METHODS FOR VERIFYING LEARNING AND FOR EVALUATION

The exam consists of an oral exam. Passing the exam requires a minimum grade of 18/30.

The requirements for achieving the maximum score (30/30 with honors) are::

Complete knowledge of the program, without areas of deficiency

Ability to have flexibility in discussing the interactions between different physiological mechanisms

High display capacity in reference to the language and logical structure of the description

9. program

Cellular physiology

Intra/extracellular compartments

Cellular membrane, ionic channels , receptors

Signal transduction mechanisms

Electrochemical gradient, cellular excitability

Membrane potential, graded potentials EPSP-IPSP, action potentials

Signal transmission

Synapsis and neurotransmitters.

Membrane potential properties, muscle cell contraction.

Neuromuscular junction and muscle contraction

Nervous system

Essential principles of nervous organization

Receptor types, classified according to the stimulus type.

Transduction mechanisms. Receptive field and code of the activated sensory line.

Somatic sensitivity: touch, proprioception, thermoception and nociception

Referred pain.

Pathways of pain transmission.

Control of pain information (gate theory and central pathways descending from nociception control),

Visual system: elements of physiology of the retina

Hearing: structure and functional properties of the external and middle ear. Cochlear Physiology.

Analysis of sound frequency, intensity and localization.

Vestibular apparatus: structure, vestibular pathways and vestibular nuclei.

The chemical senses: gustatory and olfactory sensitivity.

General principles of the functional organization of the motor system.

Spinal cord.

The spinal reflexes. Organization of the reflex arc.

The proprioceptive reflexes (myotatic reflex or by stretching and inverse myotatic reflex), the flexor reflex.

Functional organization of the primary motor area and premotor areas.

Direct and indirect cortico-spinal pathways

Autonomic nervous system:

Anatomy of the Autonomous Nervous System: Enteric Parasympathetic Sympathetic

Neurotransmitters and target organs.

The muscular system

Functional characteristics of skeletal, smooth and cardiac muscle

Structural and molecular basis of muscle contraction

Skeletal muscle: excitability, neuromuscular transmission, plaque potential and action potential

Excitation-contraction coupling in skeletal muscle.

Isotonic and isometric contraction Simple shock, summation, muscle tetanus

Length / voltage and speed / voltage relationships

Motor units

Smooth, unitary and multi-unit muscle: gastrointestinal (ECA-ERA) and vascular

Cardiac muscle: excitation-contraction coupling and mechanical characteristics

Cardio-circulatory system

Action potential of the common myocardiocyte and the pacemaker cell.

Mechanical activity of the heart: anatomical-functional aspects.

Phases of the cardiac cycle: pressure and volumetric aspects.

Pressure-volume curve.

Work and performance of the heart.

Heart sounds: location, origin and characteristics. Locations for listening to heart tones.

Pulse arterial and venous.

Cardiac dynamics: systolic volume, cardiac frequency and output, venous return.

Heart rate control. Intrinsic and extrinsic regulation of cardiac activity, regulation of systolic volume, end-diastolic and end-systolic volume, Bainbridge reflex,

Starling's law of the heart.

Electrical activity of the heart: electrical properties of heart cells.

Fundamental properties and regulation of cardiac activity: excitability, automatism, conductivity, contractility.

Correlation between electrical activity and mechanical events.

The electrocardiogram (ECG).

Arterial pressure: elasticità of the arteries

Principles of hemodynamics and physical properties of the arterial and venous system.

Flow resistance: vascular factors and blood viscosity (Poiseuille's law);

Laminar flow and turbulent flow (Reynolds number);

Resistance vessels and capacitance vessels;

Relation Pressure-volume, flow and resistance relationship in the circulatory system.

The microcirculation: anatomical-functional aspects of the microcirculation; continuous capillaries, discontinuous and fenestrated; transcapillary exchanges: diffusion and filtration.

Circulation control: vasomotility, local self-regulation of the circulation.

Blood clotting

Intrinsic and extrinsic ways

The respiratory system:

Structure of the respiratory system: respiratory tract

Inspiratory and expiratory muscles

Compliance and elastance - surfactant

Respiratory volumes and respiratory rate

Pressures and gas exchanges, hemoglobin and gas transport.

Respiratory control centers - chemoreceptors
II sistema escretore:

Structure of the kidney

The functional unit is the nephron: the cortical and medullary nephrons

Filtration, reabsorption, secretion and excretion

Renal flow rate - glomerular filtration rate - filtered load - renal clearance

Tubulo-glomerular feedback

Salt water balance: hormones involved and target organs

Volemia and osmolarity, baroreceptors and osmoreceptors

Body homeostasis control centers:

The hypothalamus as the control center of body homeostasis.

pH control

The gastrointestinal system and cellular metabolism:

Structure and function of the organs of the gastrointestinal system

Exocrine glands and endocrine glands

Digestion and absorption

The main nutrients: carbohydrates, lipids and proteins and vitamins

Nutrient storage tissues.

The endocrine system:

Hypothalamic-pituitary-target organ axes

Main functions of the main hormones

Calcium phosphate balance: hormonal control.

Bone tissue: factors and hormones that regulate bone function

Physiology of the stomatognathic apparatus

Salivary function

Thermoception and intraoral pain

Chewing muscles

Central control of chewing

Chewing mechanics, passive active forces with particular reference to constraint reactions

Swallowing

Adaptive physiological stomatognathic phenomena, physiological basis of the Petrovick model

Physiological relationships between posture and the stomatognathic system