



# UNIVERSITÀ DEGLI STUDI DI PALERMO

<b>DEPARTMENT</b>	Biomedicina, Neuroscienze e Diagnostica avanzata
<b>ACADEMIC YEAR</b>	2021/2022
<b>BACHELOR'S DEGREE (BSC)</b>	BIOMEDICAL LABORATORY TECHNIQUES
<b>SUBJECT</b>	PHYSIOLOGY
<b>TYPE OF EDUCATIONAL ACTIVITY</b>	A
<b>AMBIT</b>	10338-Scienze biomediche
<b>CODE</b>	03347
<b>SCIENTIFIC SECTOR(S)</b>	BIO/09
<b>HEAD PROFESSOR(S)</b>	SARDO PIERANGELO Professore Ordinario Univ. di PALERMO
<b>OTHER PROFESSOR(S)</b>	
<b>CREDITS</b>	3
<b>INDIVIDUAL STUDY (Hrs)</b>	45
<b>COURSE ACTIVITY (Hrs)</b>	30
<b>PROPAEDEUTICAL SUBJECTS</b>	
<b>MUTUALIZATION</b>	
<b>YEAR</b>	1
<b>TERM (SEMESTER)</b>	2° semester
<b>ATTENDANCE</b>	Mandatory
<b>EVALUATION</b>	Out of 30
<b>TEACHER OFFICE HOURS</b>	<b>SARDO PIERANGELO</b> Monday 09:30 10:30 BiND- Sezione di Fisiologia umana - Corso Tukory, 129 - II piano Friday 09:30 10:30 BiND- Sezione di Fisiologia umana - Corso Tukory, 129 - II piano

DOCENTE: Prof. PIERANGELO SARDO

<b>PREREQUISITES</b>	Elements of Chemistry, Biochemistry, Physics and human Anatomy.
<b>LEARNING OUTCOMES</b>	<p>Knowledge and ability to understand At the end of the course the student should know the anatomical and functional mechanisms of the organs and systems of the human body, as well as the functional significance of the regulation and control underlying homeostasis.</p> <p>Making judgments At the end of the course the student should be able to predict and describe adaptive responses to different homeostasis variations.</p> <p>Capacity to apply knowledge and understanding At the end of the course the student should be able to detect and critically assess the main physiological parameters (arterial pulse, heart rate, blood pressure, respiratory rate, composition of body fluids and blood)</p> <p>Communication skills At the end of the course the student should be able to describe the main physiological functions of the body, even using to numerical and / or graphic examples.</p>
<b>ASSESSMENT METHODS</b>	<p>The student should answer at least two questions posed orally, about all arguments covered by the program, with reference to both the recommended books and the information provided during the lessons of the course. The final assessment aims to evaluate whether the student knows and understands the topics, as well as whether he/she has interpretative ability about the normal physiological functions and their parameters. The sufficiency threshold will be reached if the student shows knowledge and understanding of the issues at least in broad outline, and has application skills sufficient; he must also have presentation and argumentative skills allowing the transmission of his knowledge to the examiner. Below this threshold, the examination will be insufficient. The more the candidate will be able to interact with the examiner with his argumentative and presentation skills, and the more his knowledge and application capabilities will go into detail on the subjects under evaluation, the more the judgement will be positive.</p> <p>The evaluation is expressed using a 30-point scale. ECTS grades: A – A+ Excellent (30-30 cum laude) - Grade descriptors : Excellent knowledge of teaching contents; students should show high analytical and synthetic capabilities and should be able to apply their knowledge to solve highly complex problems. ECTS grade : B Very good (27-29) - Grade descriptors: Good knowledge of the teaching contents and excellent language control; students should show analytical and synthetic skills and be able to apply their knowledge to solve problems of medium and, in some cases, even higher complexity. ECTS grade: C Good (24-26)- Grade descriptors: Good knowledge of teaching contents and good language control; the students should be able to apply their knowledge to solve problems of medium complexity ECTS grade: D Satisfactory (21-23)- Grade descriptors: Average knowledge of the teaching contents, in some cases limited to the main topic; acceptable ability to use the specific discipline language and independently apply the acquired knowledge. ECTS grade: E Sufficient (18-20) - Grade descriptors: Minimum teaching content knowledge, often limited to the main topic; modest ability to use the subject specific language and independently apply the acquired knowledge. ECTS grade: F Fail (1-17) - Grade descriptors: Lack of an acceptable knowledge of the main teaching content knowledge; very little or no ability to use the specific subject language and apply independently the acquired knowledge. Exam failed.</p>
<b>EDUCATIONAL OBJECTIVES</b>	Knowledge of blood, cardiovascular, respiratory, renal, gastro-intestinal, endocrine and nervous (central and peripheral) functions.
<b>TEACHING METHODS</b>	Lessons.
<b>SUGGESTED BIBLIOGRAPHY</b>	<p>Pietro Scotto – Fisiologia – Poletto Editore AA vari – Fisiologia dell'uomo - Edi-Ermes SILVERTHORN "FISIOLOGIA: un approccio integrato. Casa editrice Ambrosiana Linda S. Costanzo - Fisiologia - Edra Per eventuali approfondimenti: Fisiologia umana. A cura di F. Grassi, Daniela Negrini e A. Porro. Poletto Editore Fisiologia Medica . Di Boron, Boulpaep . Edra</p>

## SYLLABUS

Hrs	Frontal teaching
2	<p>Composition and distribution of body fluids. Biophysics of the cell membrane. Flow, equilibrium, steady state, active and passive transport. Ion channels: passive and active (ligand dependent, voltage gated, mechanically gated). Mechanisms of diffusion and selective permeability: mechanisms leading to the development of osmotic forces, consequences on the electrolyte balance of the cell (balance of Gibbs - Donnan ). Electric characteristic of the cell. Ionic bases of the membrane potential in the resting cell; the equilibrium potential for a single ion species. Role of the <math>Na^+ / K^+</math> pump. Propagation of local potentials. Excitable membranes. Time course of the action potential: correlation with variations of cell membrane permeability. Electric threshold; factors influencing cell excitability. Propagation of the action potential (continuous or saltatory).</p>

## SYLLABUS

Hrs	Frontal teaching
2	Blood. Plasma and plasma proteins. Red blood cells. Hemolysis, globular resistance. Blood groups and Rh factor. Platelets. Hemostasis and coagulation. White blood cells. Erythrocyte sedimentation rate (ESR).
4	Cardiovascular system. Features of myocardial tissue: excitability (bathmotropism), rhythmicity (chronotropism), conductivity (dromotropism), contractility (inotropism), relaxation rate (lusitropy). Bioelectric characteristics of "common" and "specific" myocardial tissue: action potential, prepotential or pacemaker potential. Propagation of impulses in the heart. Relationship between electrical and mechanical events. Electrocardiogram: basic features and interpretation. Mechanical events of the cardiac cycle. Phases and duration of the cardiac cycle. Heart sounds . Biophysical features of the myocardial fibers. The Starling's "heart-lung preparation" and the Maestrini - Starling Law. Action of extrinsic innervation ( ortho-sympathetic and parasympathetic ) on the heart performance. Cardiac output. Factors affecting cardiac output.
3	Bloodstream: laminar and turbulent flow. Variations of blood pressure and the speed in the vascular arterial, capillary and venous sections. Blood arterial pressure: definition and determinants, systolic and diastolic arterial blood pressure, differential (systolic) and average pressure. Methods of measurement in humans. Regulation of blood pressure. Capillary circulation and exchanges. Functions of peripheral lymphatic vessels. Venous circulation. Return of blood to the heart .
4	Respiratory system. Ventilation. Upper airways. Respiratory muscles and movements. Pneumothorax. Lung volumes and capacities. Pulmonary and alveolar ventilation, anatomical and physiological dead space. Gas exchange between the lungs and the external environment. Gas physic laws. Composition of inhaled , exhaled and alveolar air, respiratory gas partial pressures. Diffusion of gases between lungs and blood. Alveolar ventilation - perfusion mismatch . Transport of gases in the blood: oxygen transportation and content, hemoglobin dissociation curves, fetal hemoglobin and myoglobin features. CO <sub>2</sub> transportation. Nervous and chemical control of ventilation: control of spinal respiratory motor neurons; pontine and bulbar respiratory nuclei and centers. Reflex mechanisms of respiratory control. Genesis of the respiratory rhythm. Peripheral carotid and aortic chemoceptor reflex. Central chemoceptors.
3	Renal tract. Glomerular ultrafiltration: ultrafiltrate rate and composition. Renal clearance: the clearance of inulin as a measure of glomerular filtration rate. Tubular reabsorption: assessment of the maximum tubular transport (TMG) . Renal threshold for glucose reabsorption. Glycosuria : diabetes mellitus and renal diabetes. Reabsorption of Na <sup>+</sup> and Cl <sup>-</sup> in the proximal and distal portions of the nephron. Tubular reabsorption of water. Osmotic and water-induced diuresis .
3	Digestive system. Mouth, pharynx and esophagus. Salivary secretion. Stomach: composition and regulation of gastric secretion; gastric motility and emptying, digestion, absorption. Small intestine, exocrine pancreas and liver: composition and regulation of the pancreatic and bile secretions; digestion and motility. Large Intestine: motility, absorption and secretion.
5	Interneuronal and cyto-neural communication. Electric and chemical synapses. Anatomical and functional characteristics of excitatory and inhibitory synapse. Post-synaptic excitatory and inhibitory potentials. Release of neurotransmitters. Postsynaptic ionoforic and metabotropic receptors. Sensory receptors: general concepts and classification; transduction and adaptation. Spinal cord: functional organization, spinal reflexes. Peripheral and central somesthesia (tactile, thermal, to pain). Somesthetic cerebral cortex. Motor control: anatomical and functional framework of the descending motor systems; the pyramidal tract. Cortical areas for motor planning, programming and execution. The anatomo-functional organization of circuits controlling motor cortical areas: a) circuits passing through the cerebellum b) circuits passing through the basal ganglia.
4	Endocrine system. Categories and mechanisms of action of hormones. Specific effects of hormones on target organs and systems: hypothalamic and adeno - pituitary hormones, feedback mechanisms controlling e hypothalamus-pituitary dependent endocrine glands; thyroid and parathyroid hormones; hormones of the adrenal cortex and medulla; sex hormones; hormonal growth control; hormonal control of blood glucose; hormonal control of serum calcium.