

<b>General Information</b>	Studies in <b>NUTRITION SCIENCE FOR HUMAN HEALTH</b>
Title of the subject	<b>Physiology of organs and nutrition</b>
Degree Course (class)	Nutrition Science for Human Health
ECTS credits	9
Compulsory attendance	No
Language	Italian

<b>Subject Teacher</b>		
Name and Surname	<b>Lucaantonio Debellis</b>	
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Place and time of reception	Campus in Via E. Orabona, 4 - Biological dept. building; floor -1 St. 26 From Monday to Friday by appointment	
<b>ECTS credits details</b>	Discipline sector (SSD)	Area
	BIO/09 General physiology	Characterizing

<b>Study plan schedule</b>	Year of study plan		Semester	
	first		first	
<b>Time management</b>	Lessons	Laboratory	Exercises	Total
CFU	8	1		9
Total hours	64	12		76
In-class study hours				
Out-of-class study hours	136	13		149

<b>Syllabus</b>	
Prerequisites / Requirements	Basic knowledge of Physics, General and Organic Chemistry, Biochemistry, Human Anatomy and Physiology.

<b>Expected learning outcomes (according to Dublin descriptors)</b>	
Knowledge and understanding	Knowledge of the physiology of apparatuses and systems; the physiological and functional aspects of the digestive system and the processes that make it possible to modify and use the food material through the digestion and absorption of food; understand the relationships between humoral, sensory, cognitive, motivational, and psychic aspects that can influence eating behavior and therefore the state of health.
Applying knowledge	Understanding of the functional significance of each body organ, its role in relation to the need for specific nutrients for maintaining homeostasis and health
Making informed judgments and choices	Being able to assess the need for specific nutrients for maintaining homeostasis and health, the nutritional qualities of foods and the health impact of particular eating behaviors. Be able to understand, analyze and evaluate the scientific and popular literature relating to nutrition.
Communicating knowledge	Ability to describe the knowledge relating to the apparatuses and systems that make up the human body with simplicity and effectiveness, with particular reference to the functional aspects related to nutrition and maintenance of health.

Capacities to continue learning	Improve the ability to learn from highly complex technical-scientific texts, monographs, scientific periodicals, IT tools and databases in the physiological and nutritional fields.
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<b>Study Program</b>	
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Content	<ul style="list-style-type: none"> <li>• <b>Nutrition</b> Primary biological needs of living beings; nutrition; autotrophic and heterotrophic organisms; food and nutrition; food and nutrients; turnover; matter and energy; principles of thermodynamics; energy measurement; law of mass balance, energy flows; biological work; homeostasis and phases of life. Biological role of nutrients; Essentiality; Bioavailability;</li> <li>• <b>Central nervous system</b> General organization of the nervous system; Development and plasticity of the nervous system; Recalls on bioelectric potentials. Irritability and cellular excitability. Synapses and classes of neurotransmitters.</li> <li>• <b>Brain areas and their roles</b> Cerebral cortex structure Primary and secondary sensory cortical areas; associative areas: motor areas. Connections between brain areas and their functions.</li> <li>• <b>Sensory perceptions</b> Psychophysics of sensory perception and relationships with nutritional function. General properties of receptors, transduction of stimuli, codification of intensity, duration and localization of the stimulus; role of the encoder; adaptation; tonic and phasic receptors; receptive field; discrimination. Somatosensory receptors: tactile; proprioceptors; thermoceptors; nociceptors and peripheral and central modulation of pain perception; primary and higher order sensory cortical areas. Vision: eye and optical media; photoreceptors; cortical projections and role of the visual cortex. Hearing: structural and functional characteristics; auditory cortical areas; verbal communication. Taste: taste sensations, gustatory indexes; receptors and translation of gustatory stimuli; taste cortical areas. Olfactory: osmophore substances; olfactory epithelium; translation of odorous stimuli; olfactory cortical areas. Effects of sensory perception on eating behavior.</li> <li>• <b>Learning and memory</b> Role of learning and memory; brain structures involved; non-associative learning (habit and sensitization); associative learning (classic-Pavlov, operant-Skinner); classification of memory forms; cellular models of construction and stabilization of mnemonic contents;</li> <li>• <b>Movement control</b> Skeletal muscle: features and function. Muscle, tendon and vestibular receptors. Cortical areas of motor control; functional and hierarchical organization of motor systems.</li> <li>• <b>Organization and control of the autonomous functions of the organism</b> Motivations, emotions and structures involved in the control of direct and indirect responses. Autonomous Nervous System: structural and functional characteristics of orthosympathetic, parasympathetic, medullary of the adrenal. Hypothalamus: functional characteristics and interactions with the endocrine system. Endocrine organs and their function. Motivation control and regulation; Limbic system; Diffuse truncoencephalic modulatory systems; Brain mechanisms of reward and dependence. Circadian rhythms and control structures; Sleep-wake cycle Emotional states; primary emotions; physiological changes and behavioral responses in emotional states. Characteristics and role of the amygdala. The regulation of eating behavior: Hunger appetite satiety Systems to regulate the state of nutrition in the short and long term; hypothalamic nuclei paraventricular, lateral and arcuate. Melanocortin system, oressigenic and anorexic control; Peripheral signals satiety and adiposity.</li> </ul>
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- **Digestive System**

Components and roles of the digestive system; hints of functional anatomy.

Vascularisation and innervation of the digestive system.

Mouth and oesophagus: teeth; chewing and swallowing, oesophageal motility, saliva secretion and its control.

Stomach: characteristics and functions; gastric motility and its control; acid and peptic gastric secretion (cellular mechanisms), neuro-hormonal control of gastric secretion; mucosal barrier and gastric protection; vomiting reflex.

Pancreas exocrine: characteristics and functions; saline and enzymatic exocrine secretion; enzymatic activation; regulation of pancreatic secretion.

Liver: characteristics and metabolic functions, hepatic detoxification; biliary secretion, enterohepatic circulation.

Cholecysts, structure and functions; cystic bile concentration; cholelithiasis; bile release regulation.

Small intestine; motility of the small intestine (segmentation and peristalsis); structure of the intestinal wall and villi; absorbent surface; saline and enzymatic secretion; principles of intestinal absorption. Duodenum, Fasting, Ileo: characteristics and functions secrete and absorbent.

Digestion and absorption of: carbohydrates, proteins (chemical and biological value of proteins), lipids (characteristics and roles of lipoproteins), vitamins, water, sodium, potassium, chlorine, calcium, magnesium, iron.

Large intestine: blind and colon: structure, functions and alterations; secretory and absorbent function.

Colon-rectal motility; faeces composition; defecation mechanism; bowel frequency.

Transport of nutrients from blood to cells: Starling forces.

Intestinal microbiota: characteristics and roles in homeostasis of the organism.

Lymphoid tissue associated with the digestive system: characteristics and functions, relationships with the functions of the immune system.

- **Evaluation of nutritional needs**

Energy balance; energy conservation, energy deposits; energy expenditure and needs; basal metabolism; direct and indirect calorimetric techniques; evaluation of energy expenditure; metabolism allometry.

Body composition; methods of fat and lean mass determination (anthropometry, plicometry, hydrostatic weighing, impedance, adipometry, DEXA, K40); body weight; body mass index; body constitution; body mass index.

Energy requirement; physical activity; analytical determination of metabolism and energy requirement; energy content of food; calorimetric bomb; energy requirement.

- **Respiratory System**

Functions and characteristics; relationship with the circulatory system; respiratory membrane and laws of diffusion

Pulmonary ventilation: phases, structures and forces involved; spirometry; lung volumes and capacity.

Diffusional exchange of O<sub>2</sub> and CO<sub>2</sub> gases; alveolar air composition.

Blood transport of O<sub>2</sub> and CO<sub>2</sub>; hemoglobin.

Nervous and chemical control of breathing: bulbopontine centers, aortic and carotid chemoreceptors;

Respiratory and metabolic acidosis and alkalosis.

- **Cardiocirculatory and lymphatic system**

The plasma and the corpuscular component of the blood.

Characteristics and functions of the small and large circle, arteries, arterioles, capillaries, veins and lymphatic vessels.

Heart; cardiac automatism; cardiac output. Venous return. Blood pressure control.

- **Excretory system**

Body water compartments.

Structure of the kidney and urinary system.

Glomerular filtration and its self-adjustment. Resorption and tubular secretion. Clearance.

	<p>Maximum transport. Kidney excretion threshold.  Urine concentration and dilution. Diuresis regulation. Renin-angiotensin-aldosterone system.  Basic acid balance of the organism. Biological buffering systems. Respiratory and renal regulation.</p> <ul style="list-style-type: none"> <li>• <b>Exercises</b></li> </ul> <ol style="list-style-type: none"> <li>1. Analytical determination of the basal metabolic rate by means of various predictive formulas.</li> <li>2. Evaluation of the basal metabolic rate by indirect calorimetry.</li> <li>3. Assessment of body composition by means of anthropometric measurements and plicometry.</li> <li>4. Assessment of body composition by impedance and adipometry.</li> </ol>
Bibliography and textbooks	<p>A. Didactic material distributed during the course  B. "ALIMENTAZIONE, NUTRIZIONE E SALUTE" di L. Debellis et al. - Ed. EdiSES.  C. "FISIOLOGIA dalle molecole ai sistemi integrati" di E. Carbone et al. - 2ª ed. - Ed. EdiSES  D. "FISIOLOGIA - Vol. 1 Molecole, cellule e sistemi - Vol. 2 Funzione d'organo e integrazione sistemica" - E. D'Angelo et al. - Ed. Edi.Ermes  E. "VANDER – FISIOLOGIA" - II edizione EP Widmaier, H Raff, KT Strang – Ed. Zanichelli.  F. Articles from scientific journals proposed during the course.</p>
Notes to textbooks	<p>The parts relating to the physiology of the digestive system and nutrition are taken from text B.  The parts concerning the physiology of the organs are mainly taken from texts C and D.</p>
Teaching methods	<p>Frontal lessons with PowerPoint presentations  Exercises in the classroom and in the laboratory.</p>
Assessment methods	<p>Ongoing oral assessment - Oral exam</p>
Evaluation criteria	<p>Assessment of the ability to present in a clear way and with adequate language the knowledge regarding:</p> <ul style="list-style-type: none"> <li>- physiology of the apparatuses and systems and their correlation with nutritional function;</li> <li>- physiological and functional aspects of the digestive system and processes that make it possible to modify foods and absorb nutrients;</li> <li>- humoral, sensory, cognitive, motivational, and psychic aspects capable of influencing eating behavior and therefore human health.</li> </ul> <p>Assessment of the ability to grasp the key elements of the various topics and to use the information learned by making adequate correlations for understanding the questions posed and for managing the answers.</p>
Further information	