

DEGREE IN RADIOLOGY, DIAGNOSTIC IMAGING AND RADIOTHERAPY TECHNIQUES

INTEGRATED TEACHING: ANATOMY, HISTOLOGY AND HUMAN PHYSIOLOGY

SSD: BIO/16, MED/36, BIO/17, BIO/09

Number of credits: 8

RESPONSIBLE TEACHER: [Andrea Vitali](#)

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MODULE: Human Anatomy

SSD: BIO 16

Number of credits: 4

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MODULO: Istologia

SSD: BIO/17

Number of credits: 1

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MODULO: Fisiologia

SSD: BIO/09

Number of credits: 2

Teacher name: [Scorretti Massimo](#)

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MODULO: Anatomia Radiologica

SSD: MED/36

Number of credits: 1

Teacher name: [Antonella Ciabattoni](#)

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PREREQUISITES

Although there are no prerequisites, minimum basic knowledge of cell biology, histology and cytology is required and basic concepts on the organization and function of cells are required. Previous knowledge of the functioning of biological systems is required in order to optimize learning and the achievement of specific objectives. This makes the teaching contents more understandable.

LEARNING OBJECTIVES

At the end of the course, the student must be able to: Describe the macroscopic organization of the human body, using anatomical terminology appropriately; describe the main body cavities; describe the individual organs of the various apparatuses and systems from a macroscopic, microscopic and topographical point of view.

The purpose of the teaching is, starting from the knowledge of the basic concepts and normal quantitative parameters of body functions and their variations in the different conditions of dynamic engagement, to develop in the student the ability to understand the principles of the functioning of the human body. The cellular mechanisms and integrated functions of the main organs and systems aimed at maintaining body homeostasis will then be analyzed in the context of changes in the environment.

The course aims to provide student with the skills necessary for the full understanding of the most important tissues of the human organism. The student should acquire correct terminology and develop those skills of interpretation and application that, the graduate, will then have to use in the planning and management of work activities.

Knowledge of the main topics of radiological anatomy (Radiographic Imaging). The student will acquire notions of physics with particular regard to the processes underlying the radiographic images. Basic radiographic projections will be discussed and the correspondence between the normal anatomy and physiology of the human body with the reference radiological pictures in traditional and non-traditional radiology.

LEARNING OUTCOMES

Knowledge and understanding

At the end of this course the student will have to:

- know basic anatomical terminology
- know the basic anatomical structures of the human body (neuroanatomy, musculoskeletal system, circulatory system, splanchnology)
- know the organization and basic structure of the central and peripheral nervous system
- Identify the components of the different systems and their physical and functional relationships
- know the structures of the various tissues that make up the human body
- know the histological organization of the various human organs
- identify the morphology of the tissues, the cells that compose them, from a morphological and functional point of view
- have the ability to synthesize and correlate the various topics
- have acquired the knowledge of the anatomical and functional organization of the apparatuses and systems that make up the human organism
- have acquired the knowledge of the anatomical and functional organization of the main control systems of the functions of organs and systems
- having acquired the ability to interpret the anatomical-physiological mechanisms and phenomena.
- have acquired the ability to synthesize and correlate the various topics
- have in-depth knowledge of the mechanisms implemented by the control systems of the functions of the organs and systems
- have an adequate knowledge of the different anatomical structures in radiographic projections
- have an adequate knowledge of the elements of radiation physics underlying the radiographic images

- have the ability to recognize the artifacts of radiographic images in order to distinguish them from anatomical structures and pathology.

Applying knowledge and understanding

At the end of the course, the student will be able to:

- Use the acquired knowledge of human anatomy and neuroanatomy for the understanding of human physiology and pathophysiology, a fundamental requirement for carrying out the profession in the health sector. The student will also be able to use the knowledge acquired for the autonomous study of aspects related to the specific field to which he will dedicate himself in the field of professional activity.
- apply the knowledge of histology to understand other closely related branches of biology such as anatomy, cytology, physiology
- possess the knowledge of cell physiology to understand the mechanisms underlying the maintenance of homeostasis
- possess the integrated knowledge of Anatomy and Physiology on the integration and control systems that regulate the main phenomena of absorption and excretion of nutrients
- possess adequate knowledge of Radiological Anatomy to be able to carry out and conduct diagnostic tests, using correct radiological techniques
- apply specific protocols for the execution of diagnostic tests
- apply quality control methodologies on the equipment necessary to guarantee safety
- use the acquired knowledge for the autonomous deepening of the subject under study
- use the knowledge acquired to approach the subsequent dedicated courses
- use the anatomical knowledge acquired to carry out projections dedicated to precise anatomical structures.

Communication skills

At the end of the course, the student must:

- know the human anatomical structures adequately and know how to use specific anatomical terminology in order to be able to relate, within the care process, with users of all ages and / or with other health professionals, in an appropriate verbal form, not verbal and written
- use correct scientific terminology to identify, at a microscopic level, the different types of cells and tissues present in the human body
- use specific scientific terminology appropriately
- know the physiological processes that occur in the human body;
- indicate with the appropriate scientific and technical terminology the radiographic projections and the different anatomical structures that can be viewed in the images obtained.

Making judgements

The student will be able to:

- develop professional autonomy in the context of a multidisciplinary approach to patient management. The acquired knowledge will allow the technician to manage the patient autonomously during the diagnostic or therapeutic technical process (data acquisition).
- carry out general assessments on the topics covered.
- carry out a basic assessment of the anatomical structures present in the images also in order to identify and correct any malpositioning of the patient.

SYLLABUS

ANATOMY

LOCOMOTOR APPARATUS (12 hours): Embryonic development of locomotor apparatus. Axial skeleton: skull, vertebral column, vertebrae, pelvic girdle. Appendicular skeleton: shoulder girdle, arm bones, forearm and hand, thigh bones, leg and foot. Joints: classification and movements. Temporo-mandibular, sternoclavicular, shoulder, intervertebral joints, elbow joint, radioulnar joints, wrist and hand. Joints of the hip, knee, ankle. Muscular skeletal system. Axial muscles: head, neck, extrinsic muscles of the eye, tongue, pharynx, larynx, main muscles associated with the spine, diaphragm, muscles of the perineum and urogenital diaphragm. Appendicular muscles: shoulder girdle, arm, forearm and hand. Muscles of the thigh, leg and foot.

CARDIOVASCULAR SYSTEM (8 hours): Embryonic development of cardiovascular system. Heart, coronary circulation, thoracic aorta, abdominal and their main branches. Willis polygon. Main arteries of the upper and lower limbs. Venous system: hollow veins and its major tributaries. Main veins of the upper limb, thorax, abdomen and lower limb. Portal circulation. Fetal circulation. General information on the lymphatic system.

SPLANCNOLGY (8 hours). Embryonic development of splanchnic organs. Microscopic and macroscopic anatomy of the digestive, respiratory, urinary, reproductive and endocrine tracts.

NEUROANATOMY (12 hours): Embryonic development of nervous system. Spinal cord: segments and internal organization: gray matter, ascending and descending tracts. Anatomy and pathways of spinal nerves, nerve plexuses and reflex arches. Brain stem (Medulla oblongata, Pons, Mesencephalon): internal and external structure. Cranial nerves: pathways and nuclei of origin and innervation. Diencephalon (Thalamus, Hypothalamus, Subthalamus, Epithalamus): internal and external structure. Thalamic and hypothalamic nuclei. Telencephalon: internal and external structure. Anatomical and functional organization of the cerebral cortex. Allocortex. Basal ganglia: anatomy and afferent and efferent pathways. Cerebellum: internal and external structure. Ventricle system. Meninges. Blood circulation of the brain and dural sinuses. Sensory system: spinothalamic tract, fasciculus gracilis and cuneatus tracts, spinocerebellar tract. Conduction of pain. Visual, auditory, gustatory, olfactory and limbic system. Motor system: pyramidal and extrapyramidal tracts. Motor nuclei. Autonomic nervous system: sympathetic and parasympathetic system. Enteric nervous system.

HISTOLOGY

PREPARATION OF TISSUES FOR HISTOLOGICAL ANALYSIS. Microscopy, preservation of biological structures, stainings.

EPITHELIAL TISSUE. General characteristics of epithelia, junctions, polarity of epithelial cells, surface specializations, basal lamina, classification of epithelia, endothelium, absorbent epithelium, pseudostratified epithelium, transitional epithelium, epidermis, glandular epithelia (exocrine and endocrine glands).

CONNECTIVE TISSUE. Histological organization: extracellular matrix (macromolecules of the ground substance, collagen and elastic fibers) and connective cells (fibroblasts, adipocytes, macrophages, plasma cells and mast cells). The different types of connective proper: loose and dense (irregular and regular). The white and brown adipose tissue. Supportive connective tissues: cartilage (cells and extracellular matrix, hyaline, elastic and fibrous cartilage, growth and repair) and bone (cells and extracellular matrix, compact and spongy bone, osteogenesis, growth and repair). Blood: plasma

and serum, cells (red blood cells, neutrophils, eosinophils, basophils, monocytes and lymphocytes), platelets, hematopoiesis. Outline of the lymphatic system.

MUSCLE TISSUE. Skeletal muscle: organization of muscle fibers, myofibrils and myofilaments, sarcomere, sarcoplasmic reticulum, neuromuscular junction, contraction mechanism, regeneration. Cardiac muscle: structure of cardiomyocytes (intercalated discs, sarcoplasmic reticulum, myofilaments), Purkinje fibers, regeneration. Smooth muscle: structure of smooth muscle cells, contractile apparatus, regeneration.

NERVOUS TISSUE. The neuron. Myelinated and unmyelinated nerve fibers. General structure of the nerves. Synapses. Glial cells.

HUMAN PHYSIOLOGY

Cell Membrane Physiology:

- Transport of ions and molecules across the cell membrane
- Membrane potential and action potential

Muscle Physiology:

- Excitation and contraction of skeletal muscle tissue.
- Neuromuscular transmission and excitation-contraction coupling.
- Motor unit

Nervous System Physiology:

- The sensory system: decoding and processing of sensory information.
- The motor system: general characteristics of the motor system: involuntary, voluntary and automatic movements; the spinal reflexes; brain stem control of movement: posture and balance. Cortical control of voluntary movements. The cerebellum: general characteristics, functions of the cerebellum. The basal ganglia: functional role.
- The autonomic nervous system.
- Integrative functions of the nervous system.

Cardiovascular Physiology:

- Myocardial physiology: functional anatomy of the myocardium, action potentials of the myocardium, contraction of the heart muscle.
- Cardiac cycle
- Nervous control of cardiac activity.
- General principles of hemodynamics.
- Regulation of circulation, blood pressure and blood flow.
- Cardiac output: principles of regulation of cardiac output.
- Heart tones.

The Respiratory System:

- Pulmonary ventilation: respiratory mechanics, lung volumes and capacities. Respiratory tract
- Gaseous exchanges: diffusion of oxygen and carbon dioxide through the respiratory membrane.
- Transport of oxygen and carbon dioxide in the blood and body fluids.
- Regulation of breathing: general principles.
- Acid-base balance regulation: general principles.

Body fluids and kidney function:

- Functional anatomy of the kidney, function of the nephron. Glomerular filtration: general principles.
- Processing of glomerular filtrate: reabsorption and tubular secretion,
- Control of osmolarity and sodium concentration of the extracellular fluid: general principles.
- Renal regulation of blood volume: general principles

The endocrine system:

-General principles of endocrinology: nature of a hormone; general picture of the endocrine glands and their hormones. Principles of general functioning of hormones.

RADIOLOGICAL ANATOMY

1. Radiographic anatomy of the head and neck region
2. Radiographic anatomy of the thorax
3. Radiographic anatomy of the abdomen and pelvis
4. Radiographic anatomy of the limbs
5. Principles of radiological protection

COURSE STRUCTURE

The Human Anatomy module is organized in lectures (40 hours) and theoretical and practical exercises. During the lessons, the explanation of human anatomy will be performed by projecting illustrative images (Power-Point). During the exercises, students will be able to use anatomical models that reproduce organs and anatomical systems in a perfectly equipped exercise room.

The Histology module is structured in 10 hours of frontal teaching (divided into lessons of 2 or 4 hours based on the academic calendar) during which the teacher makes use of Power Point presentations and uses images of histological preparations obtained under an optical microscope and electronic and audiovisual media.

The Physiology module is structured in 20 hours of frontal teaching divided into lessons of 2, 3 or 4 hours based on the academic calendar

The radiological anatomy module consists of 10 hours of frontal teaching divided into lessons of 2/3 hours as per the academic calendar, during which the teacher makes use of Power Point presentations and presents radiological images.

GRADE DETERMINATION

The learning assessment will be an **oral interview** on the subjects of the integrated teaching which will take place on the scheduled exam dates and published on the CdS website.

The verification of the learning of the Integrated Teaching (Human Anatomy, Physiology, Histology, Radiological Anatomy) is developed in a unified and integrated way by all the teachers, articulated in a single solution, i.e. we will proceed to the unitary evaluation of the Integrated Teaching for single student. Therefore, separate grades will not be made for each module and subsequent average of the results acquired by the students, but the overall and unitary evaluation of the Integrated Teaching will be carried out.

The evaluation parameters are: ability to demonstrate the knowledge of the subjects of the Integrated Teaching; critical reasoning skills on the study; quality of exposure, competence and effectiveness in the use of specialized vocabulary.

At the end of the exam, the student will be assessed as suitable or unsuitable to pass the Integrated Teaching exam (Human Anatomy, Physiology, Histology, Radiological Anatomy).

For eligible students, the unit of measurement used is the grade out of thirty.

- Ineligible (exam not passed): important deficiencies and/or inaccuracies in knowledge and understanding of the topics; limited capacity for analysis and synthesis, frequent generalisations.
- 18-20: just sufficient knowledge and understanding of the topics with possible imperfections; ability to analyze synthesis and independent judgment sufficient.
- 21-23: knowledge and understanding of routine topics; correct analysis and synthesis skills with coherent logical argumentation.
- 24-26: good knowledge and understanding of the topics; good analytical and synthesis skills with rigorously expressed arguments.
- 27-29: complete knowledge and understanding of the topics; remarkable skills of analysis, synthesis. Good autonomy of judgment.
- 30-30L: excellent level of knowledge and understanding of the topics. Remarkable capacity for analysis and synthesis and independent judgement. Arguments expressed in an original way.

OPTIONAL ACTIVITIES

Students will have the opportunity to carry out theoretical / practical exercises and participate in seminars. The professors will provide constant support during and after the lessons

HISTOLOGY In addition to teaching, the student will be given the opportunity to take advantage of tutoring activities upon request.

PHYSIOLOGY In addition to teaching, the student may be given the opportunity to participate in seminars and monographic courses. The topics of the activities are not subject to examination. The acquisition of the assigned hours takes place only with a mandatory frequency of 100% and eligibility is expected.

READING MATERIALS

- Martini, Timmons, Tallitsch: Human Anatomy,
- Tortora: Human Anatomy,
- Martini Nath: Anatomy & Physiology
- “Bloom and Fawcett's Concise Histology”, Don W. Fawcett, Ronald P. Jensch, William Bloom
– 2nd Edition - Hodder Arnold.
- “Berne & Levy Physiology”, Sixth Updated Edition
- “Sherwood” ninth edition
- “Guyton-Hall”
- Radiobiology for the radiologist / Eric J. Hall, Amato J. Giaccia.—7th ed.
- Bontrager’s Handbook of Radiographic Positioning and Techniques 9th Edition by Lampignano John; Kendrick, Leslie E., 2017

Students are encouraged to use an Human Anatomy Atlas.