



## **MEDTEC SHOOL**

**Course: Regional Anatomy and Gross Neuroanatomy**

**Year (1<sup>st</sup>-2<sup>nd</sup>-3<sup>rd</sup>-4<sup>th</sup>-5<sup>th</sup>-6<sup>th</sup>): 1<sup>st</sup>**

**Period (1<sup>st</sup>-2<sup>nd</sup> semester – annual): 2<sup>nd</sup> semester**

**Credits: 8**

### **Faculty**

Coordinator: Flavio L. Ronzoni.

Anatomy Lectures: Flavio L. Ronzoni, Isabella Barajon, Giuseppe Mercante, Alberto Paderno, Franco Servadei, Federico Pessina, Marco Riva, Tommaso Bonanzinga.

Anatomy/Radiology practicals: Flavio L. Ronzoni, Marco Francone, Franco Servadei, Letterio S. Politi, Alberto Paderno, Tommaso Bonanzinga.

### **Objectives**

This course addresses:

- a) the organization of the human body from the regional point of view, underlying the close relation of the knowledge of anatomy with clinical practice.
- b) the development and organization of the central and peripheral nervous system.

The first part of the course is focused on the general anatomical nomenclature and on a morphofunctional approach to the locomotor system as to allow the student a self-guided study of bones, joints and muscles.

In the second part of the course a clinically oriented approach is used to describe the regional anatomy of the human body: the boundaries and compartments of the body regions will be analysed as well as the organization of the organs they contain, their relations and blood supply. Special attention will be given to surface anatomy and its relevance for the physical examination.

Starting from a phylogenetic and developmental perspective, the general learning goal of the neuroanatomy course is to understand the macroscopic anatomy and internal architecture of the central and peripheral nervous system.

3D digital anatomy (Anatomage table), a radiological approach to the different body regions, a functional approach to the study of the upper and lower limb and the use of surface anatomy will be employed as the basis for the physical examination.

Key anatomical aspects will be addressed, either in specific and joint lectures or in practical activities carried out in the Anatomy lab of the simulation center.



Transdisciplinary lectures will be centered on topics at the border between medical and technological approaches, such as theory, measurement, instrumentation, simulators (Da Vinci surgical robot) and data analysis.

## **Contents**

### **GENERAL ANATOMY**

#### **Introduction and generalities (1 Lecture)**

- Define terms to describe the anatomical regions and position
- Describe the anatomical planes and axes
- Define terms to describe movements of the vertebral column and limbs
- Introduction to diagnostic imaging techniques

#### **The musculoskeletal system: bones, joints and skeletal muscles (2 Lectures)**

- Describe the general structure and classification of the bones, joints and muscles
- Integrate the knowledge of histology into the macroscopic structure of bones, joints and muscles considered as organs composed by different tissues and with their own vascularization and innervation
- Illustrate how bones and muscles contribute to the general framework and construction of human body
- Describe the anatomical bases of bone, joint and muscle functions Describe how joints can link bones with muscles allowing and/or limiting their reciprocal movements
- Describe the connective tissue integrated with bones, joints and muscles
- Illustrate how to perform a systematic description of bones and muscles
- Illustrate the general principles of biomechanics
- Describe the biomechanical characteristics of the different tissues in the musculoskeletal system
- Illustrate the biomechanical characteristics of support and movement

#### **The vascular layout (1 Lecture)**

- Define the general organization of body vascularization
- Describe systemic and pulmonary vascularization
- Illustrate the deep/superficial arterial and venous supply in the human body
- Illustrate the general organization of lymphatic drainage

#### **The integumentary system (1 Lecture)**

- Define and describe the skin, its appendages and their regional features
- Illustrate the anatomical basis of skin function

#### **The skull (3 Lectures)**

- Describe the general architecture of the skull: neurocranium and splanchnocranium
- Describe the embryological origin of the bones of the skull and their progressive ossification
- Describe the skull development and age-related changes
- Describe the position and main characteristics of the major bones of the skull
- Describe the joints of the skull
- Describe the boundaries, walls and floors of the intra and extra cranial fossae and their communications
- Identify the external and internal features of the cranial foramina and list their impulse transmission structures
- *Clinical drops: introduce some preliminary aspects of skull fractures*
- Describe the surface anatomy of the skull and its most important landmarks
- Identify the most important palpable landmarks of the skull

## **REGIONAL/CLINICAL ANATOMY**

### **Trunk: the back (2 Lectures)**

- Brief introduction to the topographic anatomy (bones, main muscles, landmarks)
- Describe the skeletal framework, joints, ligaments and back musculature
- Describe the component parts of the back and their relations to other regions
- Describe the different types of vertebrae and their functions
- Describe vascularization and innervation
- Imaging of the back
- The spinal cord: describe the macroscopic aspect of the spinal cord, ventral and dorsal nerve roots
- *Clinical focus: Radiculopathy Clinical focus: Scoliosis*

### **Trunk: the thorax (3 Lectures)**

- Describe the main anatomical characteristics of the thorax, its surface anatomy and the relations to other regions
- Recognize the topographical and anatomical divisions of the thoracic cavity, its component parts and their anatomical relations
- Illustrate the position and the anatomical relations of the primary organs of the respiratory and cardiovascular systems
- Describe the organization of blood vessels and lymphatic vessels in the thoracic cavity
- Describe blood supply to the organs of the thoracic cavity
- Describe the most relevant aspects of autonomic nerves distribution

### **Trunk: the abdomen and pelvis (5 Lectures)**

- Describe the main anatomical characteristics of the abdomen and pelvis, their surface anatomy and the relations to other regions
- Recognize the topographical and anatomical divisions of the abdominal cavity, its component parts

and their anatomical relations

- Describe the peritoneum, its ligaments, and the peritoneal cavity
- Illustrate the position of the gastrointestinal tract, abdominal viscera, and urogenital system in the abdomen
- Illustrate the position and relations of the various organs within the peritoneal cavity
- Describe the organization of blood vessels and lymphatic vessels in the abdominopelvic cavity
- Describe blood supply to the organs of the abdomen and pelvis
- Describe the most relevant aspects of autonomic nerve distribution

### **Pectoral girdle: upper limb (2 Lectures)**

- Introduction to the topographic anatomy: bones, muscles and landmarks of the upper limb
- Describe vascularization and innervation: deep and superficial arteries and veins
- Describe the main vascular anastomotic circles of the upper limb
- Describe the origin, course and function of the principal nerves of the upper limb
- Overview of the main lymph node stations of the upper limb
- Describe and define muscle groups and their main functions, summarising attachments and the somatic motor nerve supply
- Imaging of the upper limb
- Define and describe the joint movement and biomechanics of the upper limb
- Describe the fascial compartments delimiting the major muscle groups of the upper limb, explaining the functional importance of those compartments and contents
- *Clinical focus: arthroscopic anatomy of the shoulder*
- *Clinical focus: shoulder dislocation*

### **Pelvic girdle: lower limb (2 Lectures)**

- Introduction to the regional and surface anatomy of the lower limb
- Describe vascularization and innervation of the lower limb: deep and superficial arteries and veins
- Describe the main vascular anastomotic circles of the lower limb
- Describe the origin, course and function of the principal nerves of the lower limb
- Overview of the main lymph node stations of the lower limb
- Describe and define the muscle groups and their main functions, summarising attachments and somatic motor nerve supply
- Imaging of the lower limb
- Define and describe the joint movement and biomechanics of the lower limb
- Describe the fascial compartments delimiting the major muscle groups of the lower limb, explaining the functional importance of those compartments and contents
- *Clinical focus: arthroscopic anatomy of the knee*
- *Clinical focus: arthroscopic anatomy of the hip*
- *Clinical focus: the spiral fracture*

## **HEAD AND NECK**

### **Ear anatomy (1 Lecture)**

- Define and describe the bones of the ear
- Define and describe the anatomical structure of the external ear
- Define and describe the anatomical structure of the middle ear
- Define and describe the anatomical structure of the internal ear

### **Pharynx, larynx and relevant cranial nerves of the neck (1 Lecture)**

- Describe the subdivisions of the pharynx and larynx
- Describe the muscles, mucosal structures and communications of the pharynx
- Describe the cartilages, membranes and ligaments of the larynx
- Describe the muscles of the larynx, their innervation and their most important functional roles
- Describe the anatomic course and function of vagus nerve in the head and neck area
- Describe the anatomic course and function of glossopharyngeal nerve in the head and neck area
- Describe the anatomic course and function of extrapetrous facial nerve

### **Anatomy of the neck: neck triangles, fascial system and muscles (1 Lecture)**

- Define and describe the anatomical subdivision of the neck
- Define and describe the nature, insertions and anatomical course of the neck fascias
- Describe the extension, insertions and functions of the main neck muscles

### **Anatomy of the neck: vascular system, lymph nodes (1 Lecture)**

- Define and describe the neck vascular system
- Describe the course, subdivisions, and distribution of the main vascular structures of the neck
- Describe the current classification system of neck lymph nodes
- Describe the main drainage areas of the neck lymph nodes

### **Salivary glands and thyroid (1 Lecture)**

- Describe the anatomy of the major salivary glands: parotid, submandibular, sublingual
- Describe the anatomy of the minor salivary glands and their distribution
- Describe the anatomy and anatomical relations of the thyroid gland

### **Oral cavity and nose anatomy, pterygomaxillary and infratemporal fossa (1 Lecture)**

- Describe the subdivision of the oral cavity
- Describe the muscles of the tongue and floor of the mouth
- Describe the upper and the lower gum and teeth anatomy
- Describe the maxilla masticatory surfaces, the mandible and masticatory muscles
- Describe lips and cheeks anatomy
- Define and describe the three-dimensional bone structure of the nose

- Define and describe the median structures of the nose
- Define and describe the lateral nasal wall
- Define and describe the anatomical structure of paranasal sinuses
- Define and describe the structures of the pterygomaxillary and infratemporal fossa

## **NEURONATOMY**

### **Phylogenesis and general organization of the nervous system (1 Lecture)**

- Describe the nerve cell phylogenesis and the primitive neural circuits
- Describe the centralization and cephalization processes of nerve cells
- Describe the formation of the tubular nervous system and brain vesicles
- Illustrate the general morpho/functional organization of the nervous system related to its phylogenesis
- Describe the general organization of the gray and white matter
- List most common neurotransmitters/neuromodulators

### **Nervous system development (2 Lectures)**

- Describe the different phases of neurulation
- Developmental defects: neural tube closure defects and cycloopia
- Describe the neural tube histogenesis
- Describe the fundamental cross-sectional organization of the developing neural tube
- Describe the myelination process
- Describe the development of spinal nerves and peripheral nervous system
- *In the clinic: neurocristopathies*
- Describe the basic macroscopic events the neural tube undergoes forming the different portions of the central nervous system and the ventricular system
- Illustrate the events that lead to the organization of the gray and white matter in different portions: spinal cord, brainstem and brain
- *In the clinic: medulloblastoma, Arnold-Chiari malformations, communicating and noncommunicating hydrocephalus*
- Describe the basic prenatal and postnatal steps characterizing the morphofunctional maturation of the nervous system
- *Functional drops: development of the most important reflexes*
- *Developmental defects: lissencephaly*

### **Spinal cord and spinal nerves (2 Lectures)**

- Describe the relation of the spinal cord with the vertebral canal
- Describe the spinal segment, the ventral and dorsal roots and their exit level
- *In the clinic: spinal roots compression and simple maneuvers for clinical evaluation*
- Describe the meninges, the meningeal spaces and their content

- *In the clinic: vertebral metastases*
- *In the clinic: meningitis, signs and symptoms and some of the maneuvers for clinical evaluation*
- Describe the lumbar cistern and the composition of the cerebrospinal fluid
- *In the clinic: tapping the cerebrospinal fluid*
- Describe the macroscopic aspect of the spinal cord
- Describe the laminar and columnar organization of the gray matter
- Describe the main cell types of the gray matter
- *Functional drops: spinal reflexes*
- Describe the organization of the white matter and the position of the most important ascending and descending pathways

### **Brainstem, cerebellum and cranial nerves (3 Lectures)**

- Illustrate the content and organization of the posterior cranial fossa
- Describe the organization of the meninges related to the supratentorial and infratentorial compartments of the neurocranium and the venous sinuses formation
- Describe the innervation of the meninges
- Describe the most important aspects of meningeal vessels
- *Clinical drops: epidural and subdural hemorrhages*
- *Clinical drops: herniations*
- *Clinical drops: meningiomas*
- Describe the internal organization of the brainstem related to cranial nerve nuclei, specific nuclei, ascending and descending pathways
- Highlight the most important anatomical, neurochemical and functional aspects of the reticular formation
- Describe the surface anatomy of the brainstem, the origin of the cranial nerves and their exit points related to skull foramina
- Illustrate the sensory and motor organization of the cranial nerves
- Describe the surface anatomy of the cerebellum and its division in lobes
- Describe the relation of the cerebellum to the brainstem and 4th ventricle
- Describe the morphology of the 4th ventricle and its communications
- Describe the structure of a choroid plexus, the formation and circulation of the cerebrospinal fluid
- Illustrate the organization of the cerebellar gray and white matter and introduce the organization of the cerebellar cortex
- Describe the nuclei and fiber composition of cranial nerves
- Describe the innervation area of cranial nerves
- *In the clinic: describe the most important clinical signs related to cranial nerve deficits*

### **Autonomic nervous system (2 Lectures)**

- Describe the general organization of the autonomic nervous system



- Describe the neuro-chemical organization of the autonomic nervous system
- *Functional drops: fight and flight vs rest and digest*
- Describe the specific organization of the sympathetic and parasympathetic outflow pathways
- Describe the position of viscerosensory neurons and the destiny of viscerosensory fibers
- Introduce and discuss the characteristics of visceral pain
- Explain and describe the anatomical bases for visceral referred pain
- Describe the organization of the enteric nervous system

### **Telencephalon and diencephalon (2 Lectures)**

- Discuss the developmental aspects of the prosencephalic vesicle describing the organization and reciprocal relations of the telencephalic hemispheres and diencephalon
- Describe the surface anatomy of the telencephalon and its subdivision in lobes and gyri
- Describe the position of the primary and secondary motor and sensory areas in the lobes
- Describe the organization of the white matter of the cerebral hemispheres into projecting, association and commissural fibers
- Describe the basal ganglia organization and relations
- Describe the cerebral cortex organization specifically referred to the neocortex, its layers and cell types
- Describe the morphology of the lateral ventricles
- Describe the diencephalon and the third ventricle
- Describe the thalamus, its subdivisions and nuclei related to their function
- Describe the subthalamus
- Describe the hypothalamus and its most important nuclei related to their function
- Describe the position and function of circumventricular organs

### **Peripheral nervous system: spinal plexuses (3 Lectures)**

- Describe the formation of the spinal nerve and the destiny of its terminal and collateral branches
- Illustrate the formation of spinal plexuses
- Describe the position and composition of the cervical, brachial, lumbar, sacral, coccygeal spinal plexuses and their innervation area
- *In the clinic: discuss the most relevant functional problems derived from spinal plexus injuries*
- Describe the main aspects of the course and innervation area of the most important nerves (collaterals and terminal branches) originating from the plexuses
- *In the clinic: discuss the most relevant functional problems derived from injuries of the nerves originating from the spinal plexuses*
- Describe the origin, course and innervation area of thoracic nerves
- *In the clinic: injuries of the brachial and lumbosacral plexuses*

### **PRACTICALS**





**Practical 1.** The skull and its bones

**Practical 2.** The back: anatomical models and radiology

**Practical 3.** The neck: anatomical models and endoscopic techniques

**Practical 4.** The thorax: anatomical models and radiological anatomy

**Practical 5.** The abdomen and pelvis: anatomical models and radiological anatomy

**Practical 6.** The skull and the brain: radiological anatomy

**Practical 7.** The upper limb: anatomical models and radiological anatomy

**Practical 8.** The lower limb: anatomical models and radiological anatomy

## Teaching Methods

Lectures

Practicals

## Assessment

The exam consists in:

Multiple choice test.

The test is divided into two sections (General and Regional Anatomy & Neuroanatomy) for a total of 66 questions.

Each question: 0.5 points.

To pass the test, students must answer correctly to at least 36 questions (score 18/30).

At least 50% correct answers are required in General Anatomy, Regional Anatomy and 50% in Neuroanatomy.

From 60 to 63 = score 30/30.

From 64 to 66 correct answers = score 30 cum laude.

## Texts

Gray's Anatomy for Students

Churchill Livingstone

Human Anatomy

Edi-ermes

Moore & Dalley

Clinically Oriented Anatomy

Lippincott Williams & Wilkins



Gray's Anatomy The Anatomical Basis Of Clinical Practice  
Churchill Livingstone

Neuroanatomy Through Clinical Cases, Second Edition,  
by Hal Blumenfeld (Author)

## **Code of conduct**

Students who falsify attendance to classes or any teaching activities will be officially reported to the Student Office and the members of the Teaching Committee. Class attendance is mandatory. Students who do not reach 75% of attendance will be warned and reported to the Student Office. Severe cases will be dealt with by the Teaching Committee according to the University Policy.

## **Policy on Copyright and Intellectual Property**

The materials provided in class are for the sole purpose of assisting the students to learn and study. No material from this course may be redistributed without the written consent of the teachers. No material from this course may be uploaded or stored in off-campus websites or at any student organization repository.