

## Degree in Medicine and Surgery

Teaching: **Histology and Embryology**

Scientific disciplinary sector: **BIO/17**

Number CFU: **10**

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### PREREQUISITES

Although there are no propaedeutic requirements, basic concepts of cell biology are required.

### LEARNING OBJECTIVES

Aim of the integrated course of Histology and Embryology is to provide students with knowledge on the physiological organization and development of cells and tissues. During the Histology lectures fundamentals of cytology are discussed for the full understanding of the organization of tissues and their development. The organization of cells and extracellular matrix and their association in the organization of the different tissues is illustrated and discussed, together with the standard histological procedures, including microscopy approaches (optics, fluorescence and electronics), as a tool for the study of structure and development of the human organism.

### LEARNING OUTCOMES

#### Knowledge and understanding

At the end of the course of Histology and Embryology the student should have acquired:

Knowledge on the structure of the various tissues forming the human organism

Knowledge on the histological organization of the various human organs

Ability to recognize the morphology of tissues and the cells that compose them, from a morphological and functional point of view

Ability to recognize and describe the microscopic organization of tissues and organs, and the processes leading to their formation during development

Ability to synthesize and correlate the various topics.

#### Applying knowledge and understanding

At the end of the course the student should be able to:

Recognize and contextualize microscopic information.

Understand the relationship between cells and the extracellular matrix underlying the organization of the different tissues of the multicellular organism.

Apply the knowledge of histology and embryology to the subsequent study of physiology, anatomy, pathological anatomy and clinical disciplines.

### **Communication skills**

At the end of the course the student should be able to:

Use a correct scientific terminology to identify, at the microscopic level, the different types of cells and tissues present in the human body and the mechanisms of their formation during embryonic development.

### **Making judgements**

At the end of the course the student should:

Autonomously interpret histological slides and describe the processes of embryogenesis and organogenesis.

## **COURSE SYLLABUS**

### **Elements of Cytology**

Structural-functional organization of the eukaryotic cell.

Plasma membrane.

Rough and smooth endoplasmic reticulum.

Golgi apparatus and vesicle trafficking.

Lysosomes and peroxisomes

Mitochondria.

Cytoskeleton and centrioles.

Nuclear membrane.

Nuclear matrix

Chromatin. Nucleolus.

Cell cycle regulation and cell death.

### **Histology**

Introduction to tissues and their study.

Cell differentiation and histogenesis of tissues.

Epithelia.

Cell surface specializations and cell polarity.

Lining epithelia.

Glands (endocrine and exocrine).

Connective tissues: General structure and function of connective tissue; extracellular matrix, fibres, ground substance and cells.

Cartilage: Types of cartilage; chondrogenesis and cartilage growth.

Bone: Bone structure and function. Osteogenesis; bone remodelling and homeostasis.

Blood: plasma, erythrocytes, leucocytes, platelets. Hemopoiesis.

Immune system and lymphatic organs.

Muscle tissues: structure and function of the skeletal, cardiac and smooth muscle.

Nervous tissue: Neurons. Neuroglia. Nerve fibres. Synapses. Neuro muscular junction.

### **Embryology**

Spermatogenesis.

Hormonal control of spermatogenesis

Folliculogenesis and oogenesis

Hormonal control of folliculogenesis and oogenesis.

Ovarian & uterine cycles

Fertilization.

First week of development and implantation embryo.

Embryonic and adult stem cells, somatic cell reprogramming into pluripotent stem cells (iPS): concepts, definition and potentiality for tissue regeneration and repair.

Second week of development and the formation of embryonic disk.

Third week of development and the formation of primitive layers: endoderm, ectoderm and mesoderm.

The notochord and its role in embryo development.

Fourth week of development and the embryonic folding and body cavities.

Placenta and extraembryonic membranes.

ORGANOGENESIS. Development of:

- Integumentary system
- Head and neck
- Oropharyngeal apparatus
- Gut
- Respiratory system
- Urogenital system
- Skeleton and muscle system
- Nervous system
- Cardiovascular system.

### **Practical Histology**

Through the use of the optic microscope students will have to identify histological specimens, describe their organization, and correlate structure with function, at cellular and tissue level. Histological specimens to be studied are: Simple boundary epithelium: squamous (mesothelium, endothelium), cuboidal (glandular ducts) and columnar (intestine) epithelia.

Stratified boundary epithelium: squamous (esophagus) and keratinized squamous (epidermis) epithelia

Pseudostratified epithelium (trachea)

Transitional epithelium (ureter)

Glandular epithelium: intraepithelial, unicellular glands (the goblet cell); examples of exocrine (salivary glands) and endocrine (thyroid, parathyroids) glands; exo/endocrine gland: the pancreas.

Connective tissue: loose connective tissue (trachea, intestine and esophagus); dense irregular connective tissue (the skin); dense regular connective tissue (tendons).

Supportive connective tissues: tracheal cartilage and compact bone (ground and H&E)

Blood smear

Lympho-epithelial tissue of the thymus

Skeletal, cardiac and smooth muscle tissues

Nerve tissue: section of the spinal cord

## **COURSE STRUCTURE**

The Histology and Embryology course is structured in 75 hours of frontal teaching (divided into lessons of 2 or 4 hours according to the academic calendar) and 25 hours of lab practice, consisting of microscopic analysis of several histologic preparations, including sections of epithelium, lining and glandular, connective tissue proper, adipose tissue, cartilage, bone, blood and lymphatic organs, muscle tissues (skeletal, cardiac and smooth muscles) and nervous tissue (nerve and spinal cord).

## **COURSE GRADE DETERMINATION**

The acquisition of the expected learning results is evaluated through the exam. The exam consists in a written test, followed by an oral examination. The written test consists of about 60 questions, divided in multiple-choice questions, true/false questions and associations. For multiple-choice questions there are 0.5 points for each correct answer and -0.1 for every wrong answer (or not given), for true/false questions there are 0.5 points for each correct answer and -0.5 for every wrong answer, for associations there are 0.4 points for each correct answer and -0.2 for every wrong answer. The final score of the written test will be given by the sum of the partial scores assigned to each question answered correctly. To access the oral exam the student must have scored a minimum of 24 points. The oral exam includes the identification of one/two histologic slides and questions on cytology, histology and embryology.

## **OPTIONAL ACTIVITIES**

In addition to the didactic activity, the student will be given the opportunity to take advantage of tutoring activities, upon request, and to attend seminars.

## **READING MATERIALS**

Ross M.H. and W. Pawlina: Histology a text and atlas, sixth edition. Wolters Kluwer/Lippincott Williams and Wilkins.

**Schoenwolf, Bleyl, Bauer and Francis-West: Larsen's Human Embryology, fifth edition.**