

29303 - Cellular and histological biology

Syllabus Information

Academic Year: 2019/20

Subject: 29303 - Cellular and histological biology

Faculty / School: 229 - Facultad de Ciencias de la Salud y del Deporte

Degree: 442 - Degree in Odontology

ECTS: 6.0

Year: 1

Semester: First semester

Subject Type: Basic Education

Module: ---

1.General information

1.1.Aims of the course

The subject and its expected results respond to the following approaches and objectives:

The subject of Cellular Biology and Histology is part of the basic training module within the Degree of Dentistry and is essential for understanding the structure of the cell and the metabolic reactions that take place in it. Obtaining all these basic principles is important for the knowledge of the growth and development of organisms. The main objective of this subject is to show students the basic and useful basics necessary to facilitate the understanding of subsequent subjects.

Goals:

- Be able to describe, and explain the structure and function of the different cellular organelles.
- Understand and use the terminology used in health sciences related to the composition and function of the cell.
- Be able to explain the functional differences of each cell depending on the tissue of which they are part.
- Be able to explain and outline the anatomical development from the embryology of different tissues and especially those related to the oral cavity with a precise terminology.
- Be able to explain the different components, functions and structures of the stomatognathic apparatus.
- Know how to define and be able to identify dentitions and handle in a practical way the nomenclature, dental formula, dental numbering systems.
- Define, describe and identify peridentary tissues and tooth parts, as well as their references.
- To be able to topographically recognize the anatomical elements of the oral cavity and ATM, as well as to initiate the interpretation of the anatomical images that will later be used in the different diagnostic methods by more frequent images.

1.2.Context and importance of this course in the degree

1.3.Recommendations to take this course

2.Learning goals

2.1.Competences

2.2.Learning goals

2.3.Importance of learning goals

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The learning process designed for this course is based in the following aspects:

The course is structured as follows:

- 40 hours of interactive lectures
- 32 hours of laboratory sessions
- 12 hours of seminars.

Students will find materials for each lesson at least one week before their beginning in the ADD, so as they can revise them in detail before each lecture.

Laboratory practices will be held in sessions of 2 hours for each group of 12 students. Practical classes will be evaluated within the final exam and through continuous evaluation in the lab. Students will prepare a written report with the main results obtained during laboratory sessions.

Seminars in Cell Biology will deepen about Cell Biology tools or alterations in different cell components or functions related to pathology. In Histology, students will discuss about different optical and electron micrographs obtained from histological preparations.

4.2.Learning tasks

In order to help students to obtain the expected results, the course's program includes the following activities:

MASTER CLASSES (40 hours):

The theoretical contents of the subject will be taught in the master classes. The classes are participatory and are structured in 11 lessons of Cell Biology and 26 lessons of Histology.

LABORATORY CLASSES (12 hours)

The practical classes will be carried out in the laboratory and in the microscopy room and will be distributed as follows: 8 hours correspond to Cell Biology area and 24 hours to Histology. In these practical sessions, the students will learn to use the light microscope to observe different cellular structures and to study histological preparations obtained from different tissues.

SEMINARS

In Cell Biology, the students will expose a work in which they will explain in depth some Cell Biology tools or in which they will study the relationship between defects in cell composition or function and pathology.

In Histology, the seminars will consist in the discussion about optical and electron micrographs of histological preparations related to lessons previously studied.

4.3.Syllabus

CELL BIOLOGY LECTURES

1.-Introduction to Cell Biology

Cell classification. Eukaryotic cell organization. Cells as experimental models. Tools of Cell Biology: Immunocytochemistry; Nucleic acids hybridization; Microscopy; cell isolation and subcellular fractionation; Cell culture.

2.- The Origin and Evolution of Cells.

Cell theory. The first cells. The endosymbiotic theory. Prokaryotic cells. The origin of eukaryotes. Level organization of cells. Cell evolution. The tissue level of organization. Animal cells and plant cells.

3.- The Plasma Membrane

General functions of cell membrane. Chemical composition and structure. Transport of small molecules through membranes. Endocytosis.

4.- The Nucleus

The nuclear envelope and traffic between the nucleus and the cytoplasm. Internal organization of the nucleus. The nucleolus and rRNA processing. Mitotic nucleus.

5.- Protein Sorting and Transport: ER, Golgi and Lysosomes

Endoplasmic reticulum: structure and function. The Golgi apparatus: organization and function. The mechanism of vesicular transport. Lysosomes: structure and function.

6.- Bioenergetics and Metabolism: Mitochondria, Chloroplasts and Peroxisomes

Organization and function of mitochondria. The genetic system of mitochondria. Protein import and mitochondria assembly. Chloroplasts: structure and function. The chloroplast genome. Import and sorting of chloroplast proteins. Peroxisomes

7.- The Cytoskeleton and Cell Movement

Microfilaments, microtubules and intermediate filaments.

8.- The Cell Cycle

The eukaryotic cell cycle. Regulators of cell cycle progression. Mitosis. Meiosis and fertilization.

9.- Cell Signaling

General principles of Cell Signaling. Signaling molecules and their receptors. Functions of cell surface receptors. Pathways of intracellular signal transduction. Signal transduction and the cytoskeleton.

10.- Cell Differentiation and Tissue Formation

Proliferation of differentiated cells. Stem cells and the maintenance of adult tissues. Pluripotent stem cells, nuclear reprogramming and regenerative medicine.

11.- Cell Biology of Cancer

Cancer concept. Development and causes of cancer. Properties of cancer cells. Transformation of cells in culture. Oncogenes. Tumor suppressor genes. Cancer invasion and metastasis.

HISTOLOGY:

In these classes theoretical content of the subject should be studied taking into account that students have to previously have studied each unit, always based upon the information contained in the web site.

UNIT 1.- INTRODUCTION TO HISTOLOGY. Definition of Histology. Definition of tissue. Basic types of tissues.

EPITHELIAL TISSUE

UNIT 2. EPITHELIAL TISSUE

DEFINITION. EMBRYONIC ORIGIN OF THE EPITHELIUM: Ectoderm-derived epithelium. Endoderm-derived epithelium. Mesoderm-derived epithelium. Epithelial tissue functions. TYPES OF EPITHELIUM: Lining epithelium. Glandular epithelium.

UNIT 3.- EPITHELIUM

CLASSIFICATION. EPITHELIUM TYPES: Simple squamous epithelium. Simple cubical epithelium. Simple columnar epithelium. Pseudostratified columnar epithelium. Transitional epithelium. Stratified squamous epithelium. Stratified columnar epithelium. CYTOLOGICAL FEATURES: Specializations of the lateral surface. Specializations of the free surface. Specializations of the basal surface. PROPERTIES of the epithelium.

UNIT 4. EXOCRINE GLANDS

GENERAL: Mechanism of secretion. Release mechanisms for the secreted product. Regulation of exocrine secretion. EXOCRINE GLAND CLASSIFICATION: Depending on the number of cells. According to the excretory duct. According to the secretory portion. Depending on the nature of the secreted product

TYPES OF EXOCRINE GLANDS: Goblet cells. Secretory sheet. Intraepithelial glands. Simple tubular glands. Simple tubular glands. Simple branched tubular glands. Simple branched acinar glands. Composite tubular glands. Compound acinar glands. Compound saccular glands. HISTOLOGICAL ORGANIZATION OF An Exocrine gland . EXOCRINE GLAND FUNCTIONS.

UNIT 5. ENDOCRINE GLANDS

Mechanisms of intercellular communication. Autocrine secretion. Paracrine secretion. Endocrine secretion. Synaptic secretion. Morphology: isolated endocrine cells. Endocrine cells grouped inside other structures. Endocrine cells that are true endocrine glands. Cytologic features: polypeptide secreting cells. Steroid-secreting cells. STORAGE OF HORMONES: Inside secretory granules. As follicular colloid (thyroid).

SUPPORT AND CONNECTIVE TISSUES

UNIT 6. INTRODUCTION

DEFINITION OF CONNECTIVE TISSUE. Connective tissue components: Extracellular matrix and Cells. VARIETY OF CONNECTIVE TISSUE.

UNIT 7. EXTRACELLULAR MATRIX

Collagen fibers: Structure. Ultrastructure. Arrangement of molecules of tropocollagen. Collagen types. Reticulin fibers: Structure. Ultrastructure. Elastic fibers: Structure. Ultrastructure. ADHESIVE GLYCOPROTEINS: Laminin. Fibronectin. Entactin. Tenascin. PROTEOGLYCANS: Types of glycosaminoglycans and location. Cartilage proteoglycan. Nomenclature. Functions.

UNIT 8. CELLULAR TYPES

FIBROBLAST: Structure. Ultrastructure. Function. Macrophage: mononuclear phagocyte system. Structure / ultrastructure. Biological properties. The macrophage in the immune system. PLASMA CELL: Origin and location. Structure. Ultrastructure. Function. MASTOCYTE: Origin and location. Structure. Ultrastructure. Function.

UNIT 9. VARIETY OF CONNECTIVE TISSUE

Soft Connective Tissue : Features. Location. Dense Connective Tissue. Mucoïd Connective Tissue: Features. Location. ELASTIC CONNECTIVE TISSUE: Features. Location. RETICULAR Connective Tissue: Features. Location. Connective tissue functions.

UNIT 10. ADIPOSE TISSUE

INTRODUCTION. WHITE or unilocular adipose tissue: Distribution. Structure. Ultrastructure. BROWN or multilocular adipose

tissue: Distribution. Structure. Ultrastructure. Histogenesis of adipose tissue. Histophysiology OF Adipose TISSUE.

UNIT 11.- CARTILAGE TISSUE

INTRODUCTION. Hyaline cartilage: Histogenesis. Location. Structure. Ultrastructure: chondrocyte and extracellular matrix. ELASTIC CARTILAGE: Location. Structure. FIBROUS Cartilage: Location. Structure.

UNIT 12.- BONE TISSUE

DEFINITION. PROPERTIES OF BONE TISSUE. FUNCTIONS OF BONE TISSUE. STRUCTURE OF A BONE Macroscopic STRUCTURE. MICROSCOPIC STRUCTURE. BONE MATRIX. BONE CELLS: osteoprogenitor cells. Osteoblasts. Osteocytes. Osteoclasts. FORMATION OF BONE TISSUE: endochondral ossification and membranous ossification.

UNIT 13.- JOINTS

Sinartrosis: syndesmosis. Synchondrosis. Synostosis. Amphiarthrosis: Ligaments. Joint capsule.

MUSCLE TISSUE

UNIT 14. INTRODUCTION

CONCEPT OF MUSCLE TISSUE. CLASSIFICATION OF MUSCLE TISSUE. OTHER TYPES OF contractile cells: myoepithelial cells. Myofibroblasts. Pericytes.

UNIT 15.- SMOOTH MUSCLE

LOCATION. SMOOTH MUSCLE FIBER: Structure. Ultrastructure. Modes of association. Histophysiology.

UNIT 16.- STRIATED SKELETAL MUSCLE

HISTOLOGICAL ORGANIZATION OF MUSCLE. STRIATED SKELETAL FIBER MUSCLE: Structure. Fiber types. Ultrastructure. CHEMICAL COMPOSITION. BASIC MECHANISM MUSCLE CONTRACTION

UNIT 17.- CARDIAC MUSCLE

DIFFERENCES BETWEEN SKELETAL AND CARDIAC STRIATED MUSCLE. STRIATED CARDIAC MUSCLE FIBER: Structure. Ultrastructure. DIFFERENCES BETWEEN atrial and ventricular cells. CARDIAC CONDUCTION TISSUE: nodal cells. Purkinje cells.

BLOOD

UNIT 23. INTRODUCTION TO THE BLOOD

COMPOSITION OF BLOOD. STAIN OF A BLOOD SAMPLE. FUNCTIONS OF BLOOD.

UNIT 24.- BLOOD CELLS

Erythrocytes : Structure. Ultrastructure. Function. Platelets: Structure. Ultrastructure. Function. Neutrophil: Structure. Ultrastructure. Function. Eosinophil: Structure.

Ultrastructure. Function. Basophil: Structure. Ultrastructure. Function. Lymphocyte:

Structure. Ultrastructure. Types of lymphocytes.

UNIT 25.- HEMATOPOIESIS

PRENATAL hematopoiesis. BONE MARROW: Location. Structure: stroma and parenchyma. ERYTHROPOIESIS: Granulopoiesis. MONOPOIESIS: Lymphopoiesis. Trombopoiesis.

ODONTOLOGIC HISTOLOGY

UNIT 26.- ENAMEL, PERIODONTAL LIGAMENT, Alveolar BONE, GUM, dentogingival UNION, PRIMARY TEETH, buccal mucosa, lips, cheeks, floor of the mouth, palate, tongue. Physical properties. Chemical composition. Histological structure

LABORATORY SESSIONS:

CELL BIOLOGY

- 1.- Light Microscope use: Plant cells and organelles
- 2.- Observation of prokaryotic cells.
- 3.- Animal cell: observation and culture
- 4.- Mitosis

HISTOLOGY

In practical sessions, the students will observe different histological preparations including

- Basic Histology tools: light microscope use
- Lining epithelium
- Exocrine glands
- Endocrine glands
- Connective tissue
- Adipose tissue
- Cartilage tissue
- Bone tissue
- Muscle tissue
- Teeth and periodontal tissue

4.4.Course planning and calendar

Schedule of face to face sessions and Works presentation:

The schedule will be published by the Facultad de Ciencias de la Salud y del Deporte for 2019-2020 course.

4.5.Bibliography and recommended resources

- La célula / Geoffrey M. Cooper, Robert E. Hausman. 6ª ed., [reimp.] Madrid : Marbán, cop. 2014 (BB)
- Biología Celular Biomédica/ Calvo, A.; 1ª Edición. Ed. Elsevier, 2015 (BB)
- Introducción a la biología celular / Bruce Alberts ... [et al.] . 3ª ed. Buenos Aires ; Madrid [etc.] : Editorial Médica Panamericana, cop. 2011 (BB)
- Biología molecular de la célula / Bruce Alberts ... [et al.] ; traducido por Mercé Durfort i Coll, Miquel Llobera i Sande . 5ª ed. Barcelona : Omega, D.L .2010 (BB)
- Biología celular y molecular / Luis Felipe Jiménez García y Horacio Merchant Larios (coords.). Mexico : Pearson Educación de México, S.A., 2003 (BB)
- Biología celular y molecular / Harvey Lodish ... [et al.] ; supervisión de la traducción a cargo de Norma B. Sterin de Speziale, Norberto A. Vidal . 5ª ed., 3ª reimp. Buenos Aires ; Madrid [etc.] : Editorial Médica Panamericana, 2009 (BB)
- Biología celular y molecular / James Darnell, Harvey Lodish, David Baltimore . 2ª ed. Barcelona : Omega, D.L. 1993 (BB)
- Biología celular y molecular / E.D.P.de Robertis, E.M.F. de Robertis . - 11ª ed., 5ª reimp. Buenos Aires : Editorial El Ateneo, 1994 (BB)
- Biología celular y molecular : conceptos y experimentos / Gerald Karp ; 6ª Edición. McGraw Hill, 2014 (BB)
- Citología e histología vegetal y animal : biología de las células y tejidos animales y vegetales / Ricardo Paniagua Gómez-Alvarez ... [et al.] . 3a ed.,[reimpr.] Madrid [etc.] : McGraw-Hill.Interamericana, 2004 (CB)
- Biochemistry and Molecular Biology of Plants/Buchanan BB, Gruissem W, Jones RL; American Society of Plant Physiologists, 2002 (CB)