1. OVERVIEW

Subject Area	Histology
Degree	Medicine
School/Faculty	Biomedical and Health Sciences
Ac. Year	1º
ECTS	4
Type	Compulsory
Language(s)	Spanish
Delivery Mode	On campus
Semester	2º

2. INTRODUCTION

Understanding of the basics of General Histology is essential to understanding how the human body works. This subject includes studying the structure and function in normal conditions of specific types of cells of the nervous system, muscles, connective tissue, epithelium, glands as well as how they are organised and work together. The aim is for students to learn how to identify the different types of cells which make up the different tissues and understand the relationship between the characteristics of these cells and human physiology.

3. SKILLS AND LEARNING OUTCOMES

Key skills (CB, by the acronym in Spanish):

- CB1: Students will demonstrate their knowledge and understanding of a study area that builds on general secondary school education, and will usually be at the level where, with the support of more advanced textbooks, they may also demonstrate awareness of the latest developments in their field of study.
- CB2: Students can apply their knowledge to their work professionally and possess the necessary skills, usually demonstrated by forming and defending opinions, as well as resolving problems within their study area.

General skills (CG, by the acronym in Spanish):

- CG7: Understand and recognise the normal structure and function of the human body. This includes studies of molecules, cells, tissue, organs and systems in the different stages of life.
- CG11: Understand and recognise the effects of growth, development and ageing on the individual and the social environment.

Cross-curricular skills (CT, by the acronym in Spanish):

- CT6: Problem solving: ability to solve an unclear or complex issue or situation which has no established solution and requires skill to reach a conclusion.
- CT8: Planning and organization: ability to set objectives and choose the right means to fulfil them

through the efficient use of time and resources.

- CT10: Independent learning: the ability to govern your own development by choosing the most effective lines of action, strategies, tools and opportunities to independently learn and apply knowledge to practice.

Specific skills (CE, by the acronym in Spanish):

- CE 1.1.1: Recognising the structure and function of cells. Biomolecules. Metabolism. Metabolic regulation and integration.
- CE 1.2.1. Understanding the morphology, structure and function of the different systems and apparatus: cardiovascular, digestive, locomotor, reproductive, urinary, respiratory, endocrine, immune, integumentary, circulatory, and central and peripheral nervous systems. Growth, maturity and ageing of the different systems and apparatus. Homoeostasis. Adaptation to environment
- CE 1.2.2: Using basic laboratory techniques and materials. Interpreting a normal analysis. Using macroscopic, microscopic and imaging techniques to recognise the morphology and structure of tissue, organs and systems. Performing functional tests and determining vital signs and how to interpret them. The basic physical examination.

Learning outcomes (RA, by the acronym in Spanish):

- RA1: Understand the levels of organisation and molecular and cellular function.
- RA2: Understand the structural and functional organisation of the main tissues of the human body.
- RA3: Learn how to connect different types of tissues to form organs and systems.
- RA4: Learn about the normal function of cells and tissues in the different stages of life.
- RA5: Learn about the mechanisms of tissue degeneration, repair and regeneration.
- RA6: Understand the normal microscopic morphology and structure of the different systems and apparatus.
- RA7: Understand the concept of tissue engineering.
- RA8: Use macroscopic, microscopic and imaging techniques to recognise the structure of human tissue.
- RA9: Use the main fixation, staining and preservation techniques for biological samples.

The following table shows how the skills developed in the course match up with the intended learning outcomes:

Skills	Learning outcomes
CB1, CB2, CG1, CT6, CT8, CT10, CE3	RA1. Understand the levels of organisation and molecular and cellular function.
CB1, CB2, CG1, CT6, CT8, CT10, CE1, CE3, CE4	RA2. Understand the structural and functional organisation of the main tissues of the human body.
CB1, CB2, CG1, CT6, CT8, CT10, CE3, CE4	RA3. Learn how to connect different types of tissues to form organs and systems.
CB1, CB2, CG1, CG2, CT6, CT8, CT10, CE1, CE3	RA4. Learn about the normal function of cells and tissues in the different stages of life.
CB1, CB2, CG1, CG2, CT6, CT8, CT10, CE1, CE3	RA5. Learn about the mechanisms of tissue degeneration, repair and regeneration.
B1, CB2, CG1, CG2, CT6, CT8, CT10, CE3, CE4	RA6. Understand the normal microscopic morphology and structure of the different systems and apparatus.
CB1, CB2, CG2, CT6, CT8, CT10, CE1, CE3, CE4	RA7. Understand the concept of tissue engineering.
CB1, CB2, CG1, CG2, CT6, CT8, CT10, CE1, CE3, CE4	RA8. Use macroscopic, microscopic and imaging techniques to recognise the structure of human tissue.

CB1, CB2, CG1, CG2, CT6, CT8, CT10, CE4	RA9. Use the main fixation, staining and preservation techniques for biological samples.

4. CONTENTS

1.- Introduction to histology

1.1.- The concept of tissue
- 1.2.- Preparing samples
- 1.3.- Conventional staining
- 1.4.- Immunohistochemical and molecular techniques
- 1.5.- Special electronic microscope techniques
- 1.6.- Interpretation of histological sections

2.- The extracellular matrix
- 2.1.- The basal lamina
- 2.2. Components
  - 2.2.1- Laminins
  - 2.2.2.- Type IV collagen
  - 2.2.3.- GAGs
- 2.3.- Proteoglycans
- 2.4.- Elastin
- 2.5.- Elastin, Fibrilin Proteoglycans

3.- Epithelium linings
- 3.1.- General characteristics
- 3.2.- Functions of epitheliums
- 3.3.- Morphological classification
- 3.4.- Renewal of epithelial cells
- 3.5.- Alterations in the epitheliums

4.- Glandular epitheliums
- 4.1.- Glandular cells
- 4.2.- Type of glands
  - 4.2.1.- Exocrine glands
    - 4.2.1.1.- Classifications
  - 4.2.2.- Endocrines

5.- Actual connective tissue

5.1.- Histogenesis of connective tissue
- 5.2.- Components of connective tissue
  - 5.2.1.- Connective tissue cells
    - 5.2.1.1.- Fixed cells
    - 5.2.1.2.- Free cells
  - 5.2.2.- Extracellular matrix
    - 5.2.2.1.- Ground substance
    - 5.2.2.2.- Protein fibres
      - 5.2.2.2.1.- Elastin, Fibrilin
      - 5.2.2.2.2.- Reticular fibres
- 5.3.- Classification
  - 5.3.1.- Loose connective tissue
  - 5.3.2.- Dense connective tissue
  - 5.3.3.- Reticular connective tissue
  - 5.3.4.- Elastic connective tissue
  - 5.3.5.- Mucous connective tissue

6. Adipose tissue
    6.1.- Histogenesis
    6.2.- Functions
    6.3.- Multilocular adipose tissue
        6.3.1.- Thermogenesis
    6.4.- Uniocular adipose tissue

7. Cartilage
    7.1.- Functions
    7.2.- General characteristics
    7.3.- Types of cartilage tissue
    7.4.- The extracellular matrix
    7.5.- Cell types
    7.6.- Perichondrium
    7.7.- Hyaline cartilage
        7.7.1- Histogenesis
        7.7.2.- Appositional growth
        7.7.3.- Interstitial growth
        7.7.4.- Histophysiology
    7.8.- Elastic cartilage
    7.9.- Fibrous cartilage

8. Bone
    8.1.- Functions
    8.2.- General characteristics
    8.3.- The bone matrix
        8.3.1.- Organic components
        8.3.2.- Inorganic components
    8.4.- Bone tissue cells
        8.4.1.- Bone resorption process
    8.5.- Macroscopic structure of the bone
    8.5.1.- Compact bone
        8.5.2.- Spongy bone
    8.6.- Microscopic structure of the bone
        8.6.1.- Woven bone
        8.6.2.- Lamellar bone
        8.6.3.- Lamellar structure of the compact bone: the osteon
        8.6.4.- Spongy bone
    8.7.- Bone marrow
    8.8.- Histogenesis of bone
        8.8.1.- Intramembranous ossification
        8.8.2.- Endochondral ossification
    8.9.- Bone growth in length: the physeal plate
    8.10.- Bone remodelling
    8.11.- Bone repair

9.- Muscle tissue
    9.1.- Functions
    9.2.- Properties of muscle fibres
    9.3.- Types of muscle tissue

9.4.- Skeletal muscle
9.4.1.- Histogenesis
9.4.2.- Skeletal muscle fibre
9.4.2.1.- The sarcomere
9.4.2.2.- Dystrophin
9.4.2.2.1.- Muscular dystrophies
9.4.2.3.- Sarcoplasmic reticulum
9.4.2.4.- T-tubules
9.4.3.- Neuromuscular junctions
9.4.4.- Histological organisation of the striated skeletal muscle tissue
9.4.5.- Types of skeletal muscle fibre
9.4.6- Muscle spindles
9.4.7.- Golgi tendon organs
9.5. Cardiac muscle
9.5.1.- Histology of the cardiac muscle
9.5.2.- Striated cardiac muscle fibre
9.5.3.- Sarcoplasmic cones
9.5.4.- Sarcoplasmic reticulum and T-tubules
9.5.5.- Intercalated discs
9.6.- Smooth muscle
9.6.1.- Types and location of smooth muscle
9.6.2.- Histological structure of smooth muscle
9.6.3.- Smooth muscle fibre
9.6.3.1.- Sarcoplasmic cones
9.6.3.2.- Dense bodies
9.6.3.3.- Caveolae
9.7.- Muscle tissue regeneration
10.- Nerve tissue
10.1.- Functional classification of the nervous system
10.2.- Topographical classification of the nervous system: grey and white matter
10.3.- Nerve tissue cells: Neurons
10.3.1.- Types of neurons
10.4.- Nerve tissue cells: Neurology
10.4.1.- Glial cells of the CNS
10.4.1.1.- Astrocytes
10.4.1.2.- Oligodendrocytes
10.4.1.2.1.- Myelin sheath of the CNS
10.4.1.3.- Microglia
10.4.1.4.- Ependymal cells
10.4.2.- Neurology of the PNS
10.4.2.1.- Schwann cells
10.4.2.1.1.- Myelin sheath of the PNS
10.5.- Myelinated and unmyelinated axons
10.6.- Organisation of the peripheral nerves

5. TEACHING/LEARNING METHODS

The types of teaching/learning methods are as follows:

1. **Theory classes in the classroom:** Explanatory theory classes which encourage debate and student participation, study of images seen through microscope, and watching and studying complementary videos and animations.

2. **Active classroom methods:** students will also work on subject theory through the following active learning methods: collaborative learning, case studies and problem-based learning.

3. **The practical classes** will take place in different **laboratories**. They will complement theory learning and will aim to provide students experience in the basic subject methods. Students will learn to observe, experiment, interpret facts and overall, to familiarise themselves with scientific methods.

The assessment of each activity is explained at the beginning of each and will be evaluated in different forms: spoken, written, individual or as a group.

6. LEARNING ACTIVITIES

The types of learning activities, plus the amount of time spent on each activity, are as follows:

On campus:

Learning activity	Number of hours
Theory/practical learning activities on-campus	46
Directed learning activities	11
Independent learning	30
Theory/practical learning activities: Evaluated tests	4
Tutorials	9
TOTAL	**100**

7. ASSESSMENT

The assessment methods, plus their weighting in the final grade for the course, are as follows:

On campus:

Assessment system	Weighting
Knowledge tests	70
Evaluated activities and laboratory work	30

The subject will be assessed continuously. Students can pass the course so long as they pass all the objective tests and activities which correspond to each teaching block and have attended at least 50% of the theory and practical classes. Each theory block is worth two grades which will be calculated as follows:

- Multiple-choice tests which assess knowledge acquired and certain skills: 70% of the final grade.
- Assessment of the different active and practical work that has been carried out over the academic year: 30% of the final grade. Each of these activities and practical work will be assessed by means of a questionnaire at the end of each one.
- For the active and practical work, we will assess skills and knowledge acquired during these tasks, as well as student attitude.
- It is compulsory to get a **5 or above in each teaching block assessed**. The final grade will be the average of the marks for each of the blocks, as indicated in the table. If students do not pass any of the assessed teaching blocks, the grade on record will be a 4. The grades published on the virtual campus will be **provisional** until the test has been reviewed.
- The assessment method for the two assessed blocks can be based on: test-type questions,

short questions, open-ended questions with no limit, correspondence questions, questions with embedded answers, information synthesis tables, oral presentations, etc.

- If there are any **changes to assessment dates**, in accordance with the rules for changing these dates, the format may be changed from what is established in the general examination period.

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