UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Cytology and Histology

2122-1-E1301Q086-E1301Q094M

Aims

The course is divided into two modules: **Cytology and Histology** (first module) and **Comparative Anatomy** (second module).
The cytology and histology module will provide the student with the basic knowledge of the animal eukaryotic cell, focusing on its morpho-functional characteristics to acquire, with the contents of histology, the knowledge concerning tissue organization. The lessons will be supplemented by laboratory work.
The comparative anatomy module is divided into two parts. The first part will provide the student with the basic concepts related to the phases that regulate the development of Vertebrates (from fertilization to organogenesis), concepts that will allow them to understand the embryological derivation of organs, systems, knowledge necessary for anatomy. The content of the anatomy will provide the student with notions related to the anatomy of Vertebrates in a functional and evolutionary key. The theoretical concepts provided in the classroom will be followed by the laboratory experience.
1. Knowledge and understanding
At the end of the course the student will acquire knowledge about the animal eukaryotic cell and the organelles that characterize it in morpho-functional terms and the organization of the tissues. Furthermore the student will know the organization of organs, systems from a morphofunctional and comparative point of view and will be able to recognize the histo-anatomical preparations.
2. Applying knowledge and understanding
At the end of the course the student will be able to apply the knowledge acquired in point 1 to the subsequent subjects he will study in the following years.
3. Making judgements
The student must be able to critically process the acquired knowledge and choose the most appropriate approach to link the morpho-functional characteristics of the animal eukaryotic cell to more complex organization levels such as tissues, organs and systems.
4. Comunication skills
At the end of the course the student will be able to describe, with an appropriate scientific language, the cell organization and arrive, through the description of tissues and organs, to the systems.
5. Learning skills
At the end of the course, the student will have the skills to face the subsequent studies that require basic

knowledge of cytology, histology and anatomy.
Furthermore the student will be able to associate the knowledge learned with the concepts that he will assimilate in the subsequent studies that require cyto-isto-anatomical knowledge as prerequisites.

Contents

Cytology and Histology Module: study of the animal eukaryotic cell and of the organelles that characterize it with a morpho-functional approach. The lectures will be accompanied by the mandatory laboratory activity in which the theoretical-technical information for the preparation of histological preparations will be provided. Furthermore, the student will observe the histological preparations to recognize the structure of the tissues with an optical microscope. This knowledge will be preparatory to the contents of the Comparative Anatomy module.
Comparative Anatomy Module: after an introduction to embryology, the study of the anatomical organization of Vertebrates will be addressed, considering the functional and evolutionary aspects. The lectures will be accompanied by the mandatory laboratory activity to observe histo-anatomical samples under the microscope

Detailed program

Cytology
The world of the cell. Morphology of the prokaryotic and eukaryotic cells. Hierarchy and complexity of biological organization.
- Structure and function of macromolecules. Carbohydrates, proteins, lipids and nucleic acids
- Structure and function of biological membranes. Passive transport. Active transport.
- Intracellular membrane systems. Structure and function of the endoplasmic reticulum and the Golgi apparatus. Control of the fate of synthesized proteins. Lysosomes and peroxisomes.
- Mitochondria. Morphology and function.
- The cytoskeleton. Microtubules, microfilaments and intermediate filaments. Relationship between cytoskeleton and other cellular structures. The junctions.
- Nucleus: Morphology. Nuclear envelope and nucleus-cytoplasm traffic. From DNA to the chromosome: organization. Notes on DNA duplication. Nucleolus: structure and function.
- Transcription and translation of gene information. Overview of the RNA structure. Genetic code: definition. Overview of the mechanisms that regulate translation.
- Cellular reproduction. The phases of the cell cycle: overview. Phase M: stages of mitosis and cytokinesis. Meiosis: the process that regulate it and its biological role.

Laboratory: Elements of Histology
- The microscope. Preparation of histological preparations.
- Epithelial tissues: coating epithelia, glandular epithelia.
- Tissues with a trophic-mechanical function: connective tissue proper (lax, dense ...), cartilage, bone tissue, adipose tissue. Blood.
- Muscle tissues: smooth, skeletal and cardiac muscle tissue.
- Nervous tissue.

The following topics will be investigated by observing histological samples with an optical microscope.

Comparative Anatomy
- General principles of embryology. From the zygote to the embryo: segmentation; gastrulation; organogenesis.
- Classification and main characteristics of the various classes of Vertebrates and their progressive evolution.
- Hierarchical organization: cell-tissues-organs-apparatuses / systems-organism.
- Tegumentary apparatus: functional and structural aspects. The tegument and derivatives in Vertebrates. Skin pigmentation.

- Digestive apparatus: general characteristics of the digestive tract in Vertebrates, microscopic aspects and function of the different sections of the digestive tract (esophagus, stomach, intestine). Liver and pancreas: morphology, function and relationship with the digestive apparatus.
- Respiratory apparatus: general characteristics in Vertebrates (gills and lungs) and its evolution in tetrapods.
- Uro-genital apparatus: anatomy and evolution of the excretory apparatus in Vertebrates. The functional unit of the kidney: microscopic aspects. Structural aspects of the testis (cystic and tubular) and of the ovary (sacciform and parenchymatous).

Laboratory: Comparative Anatomy

Microscopic observation of histo-anatomical preparations related to the topics addressed in class. A comparative analysis will be performed.

Prerequisites

Basic knowledges of biology

Teaching form

First semester - module of Cytology and Histology: lectures in the classroom (40 h) and obligatory practical laboratories for Histology (10 h).

Second semester - module of Anatomy: lectures in the classroom (40 h) and obligatory practical laboratories for microscopic anatomy (10 h).

The course is supported by tutoring activities (30 h) for each module, distributed throughout the academic year).

Textbook and teaching resource

Cytology: The student can choose one of the following texts:
- Cellular and molecular biology. Concepts and experiments. G. Karp published EdiSes
- The essential molecular biology of the cell. Alberts B., et al. published by Zanichelli (paper version - electronic text)
- Cells. G. Lewin, published Zanichelli

Scientific articles and teaching material suggested by the teacher.

Histology:
- Histology and elements of microscopic anatomy - Dalle Donne et al., EdiSES.

Comparative Anatomy

Comparative Anatomy Manual. E. Giavini, E. Menegola. published by EdiSes
Histology text used in the previous semester.
All slides can be found at the Moodle webpage related to the teaching module.

Semester

Cytology and Histology: first semester

Comparative Anatomy: second semester

Assessment method

Written and oral exam As the course is divided into two modules, two written tests are scheduled, followed by a single oral exam.
Written test of the Cytology and Histology module (subject to evaluation and criteria): students' knowledge of the topics covered in the lesson and their ability to recognize histological preparations are assessed.
Written test of the anatomy module (subject and evaluation criteria): the student's knowledge of the topics covered in the class is evaluated. Overcoming the written test of the Cytology and Histology module will allow the student to access the written test related to the Anatomy module. Both tests will take place in the computer room (Perception platform) (for each module 40-50 short questions, by computer test). The oral exam will follow the two written tests (the score of the written tests will not be used in the final result).

Office hours

Appointment request by e-mail to: anita.colombo@unimib.it