GENERAL OBJECTIVE
This subject aims to provide students with a basic conceptual and practical understanding of cell structure and cell functions that will allow them to understand the biological basis of pathology and therapeutics.

SPECIFIC OBJECTIVES
• To be able to identify the different cell organelles.
• To be able to establish relationships between intracellular structures and the functions that they carry out.
• To recognize the relationships that exist between the functions of the different intracellular organelles.

PROGRAMME

Theory

Introduction
1. The cell as a structural and functional unit of living systems. General characteristics of the eukaryotic cell and differences with the prokaryotic cell. Concepts of functional compartmentalization in eukaryotic cells.
3. Cell development. From the first prokaryotes to photosynthesizing prokaryotes, the food crisis. The aerobic crisis, appearance of aerobic cells. The transition from prokaryotes to eukaryotes and the endosymbiotic theory. Transition from unicellular to multicellular life.

Experimental methods for studying cells
5. Fractionation techniques and cell cultures. Cell fractionation techniques, homogenization and different types of centrifugation. Basic cell culture techniques: primary cultures and established cell lines. Microinjection.

Intracellular compartments: intracellular distribution of molecules and maintenance of cell structure

9. Molecular and structural characteristics of the endoplasmic reticulum. Structure and intracellular localization of the smooth and rough endoplasmic reticulum. Functions of the smooth endoplasmic reticulum, phospholipid synthesis. Relationship between the smooth and rough reticulum.

10. The biosynthetic machinery of the rough endoplasmic reticulum. Protein biosynthesis in the rough endoplasmic reticulum. Protein and lipid modifications. Classification and distribution of resident and secretion proteins.


Cell shape and motility: the cytoskeleton

18. The cytoskeleton. Concept of the cytoskeleton. Principal types of filament that make up the cytoskeleton: intermediate filaments, tubulin filaments and actin filaments. Principal functions of the cytoskeleton.


Relationship between the cell and its environment


Maintenance, expression and replication of genetic information: the cell nucleus


The growth and division of cells: the cell cycle

32. The cell cycle. Concept of cell cycle. The quiescent state or G0. Phases of the cell cycle: G1, S, G2 and M. Duration and principal features of each phase. Extracellular factors that regulate the cell cycle: growth factors, anchorage dependence and contact inhibition.

33. Regulation of the cell cycle. Identification of the cell cycle regulator molecules: cell fusion experiments, microinjection into the cytoplasm of Xenopus oocytes and yeast genetics. Cyclin-dependent kinases (CDKs) and the regulation of their activity. Specific CDK/cyclin complexes in the different phases of the cell cycle.


Practical training

1. Preparation of samples for optical microscopy.
2. Components of the optical microscope Observation of cells from all five kingdoms.
4. Electrophoresis and protein transfer.
5. Immunotransfer. Immunohistochemical and histochemical techniques.


Practical courses 1, 2 and 3 will last 2.5 hours and modules 4, 5 and 6 will last 5 hours.

SESSIONS ON CELL ULTRASTRUCTURE: observation and discussion of microscope slides that will be distributed to the groups for practical courses at the beginning of the course. Work will be done in students’ own time.