

## Theory program – Biology 2011-12

### **LECTURES**

- 1.- Introduction. Concept of living being. Functions of living beings. Structure of living beings: cellular and molecular level.
- 2.- Cell membrane: Morphology. Molecular organization. Fluidity of cell membrane lipids and proteins.
- 3.- Cell membrane. Differentiations. Cell junctions.
- 4.- Cell membrane: Adhesion molecules. Exocytosis and endocytosis. Receptor-mediated endocytosis.
- 5.- Endoplasmic reticulum. Ultrastructure. Molecular organization. Functions.
- 6.- Golgi apparatus. Morphology. Functions. Vesicular transport. Biogenesis.
- 7.- Lysosome: Morphology. Functions. Biogenesis. Peroxisomes: Functions. Biogenesis.
- 8.- Mitochondria. General characteristics. Ultrastructure. Functions. Biogenesis.
- 9.- Cytoskeleton. Microtubules. Centrioles. Cilia and flagella. Molecular organization.
- 10.- Contractile filaments. Intermediate filaments.
- 11.- Cytoskeleton functions: Maintenance of cell shape. Cell motility.
- 12.- The interphase nucleus. Ultrastructure. Nuclear envelope. Chromatin.
- 13.- Nucleolus and ribosome: Structure. Function. Biogenesis.
- 14.- General characteristics of chromosomes. Structure. Molecular organization.
- 15.- Chromosome cycle. Special chromosomes
- 16.- Study of human karyotype. Methodology.
- 17.- Cell division. General characteristics of mitosis. Methods of study.
- 18.- Cell division. Phases of mitosis.
- 19.- Cell division. Meiosis. Biological cycles. Phases of meiosis.
- 20.- Genetic consequences of meiosis Comparison between mitosis and meiosis.
- 21.- The genome of living beings. General characteristics of prokaryote and eukaryote genomes.
- 22.- Human genome. Gene families. Pseudogenes. Molecular concept of gene.
- 23.- Variability of genetic material. Polymorphisms. Mutation.
- 24.- Constancy of genetic material. Repair.
- 25.- Genetic regulation in prokaryotes. Operon concept. Control mechanisms.
- 26.- Genetic regulation in eukaryotes. Regulation levels.
- 27.- Transcriptional and post-transcriptional control.
- 28.- Genetic engineering. Historical introduction. Basic procedures of gene cloning. Applications.
- 29.- Cell cycle. Phases. Control of cell cycle.
- 30.- Cell aging and cell death. Hayflick experiments. Apoptosis and necrosis. Morphology. Molecular basis.

## **Practical Program**

### ***PRACTICAL SESSIONS***

#### **Microscopy lab**

1. Basis and use of the optical microscope.
2. Adaptation techniques: staining.
3. Cytochemical techniques.
4. Cell types.
5. Cell culture.
6. Cell division: mitosis
7. Electron microscopy: Study of EM images.
8. Identification of subcellular structures.
9. Identification of subcellular structures: Biopathology.
10. Revision and collection of the lab notebook.

#### **Computer lab**

1. Databases for the study of human genome.

**Discussion groups:** Presentation of a directed activity.