

**Molecular Cell Biology**

Code: 101898  
ECTS Credits: 6

Degree	Type	Year	Semester
2501230 Biomedical Sciences	OB	2	1

**Contact**

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**Use of languages**

Principal working language: catalan (cat)  
Some groups entirely in English: No  
Some groups entirely in Catalan: No  
Some groups entirely in Spanish: No

**Other comments on languages**

70% Catalan and 30% Spanish

**Teachers**

Jordi Benet Català  
Maria Oliver Bonet

**Prerequisites**

It is recommended that the student has successfully completed the subjects of "Structure and Function of Biomolecules", "Metabolism of Biomolecules" and "Cell Biology."

**Objectives and Contextualisation**

The subject of Cell Molecular Biology has a basic character in the degree and with it, it is intended that the student acquires solid knowledge on the molecular basis of the eukaryotic cellular structures. These biological knowledge is complemented with those of other basic and compulsory subjects of the syllabus, such as Cell Biology, Structure and Function of Biomolecules, Metabolism of Biomolecules, Genetics or Immunology that, as a whole, will provide to the Biomedical Science students has a good understanding of the structural and functional organization of living organisms. On the other hand, the theoretical knowledge acquired in the subject of Molecular Biology of the Cell are complemented by a practical training in the laboratory in the subject of Laboratory 2.

**Content**

**Topic 1. Chromatin remodeling:** Definition of epigenetics. Role of chromatin in the eukaryotic gene expression. Methylation of DNA. Methods for the detection of methylated DNA regions. Modification of histones and complex chromatin modifiers. Interaction between histone modifications, methylation of DNA and RNAi.

Histone variants. Remodeling complexes of SWI-SNF chromatin and NURF. Chromatin during replication and transcription. Other situations where chromatin is regulated: inactivation of X chromosome in mammalian females, RNA XITS, imprinting genomics. Test of hypersensitivity to DNase I.

**Topic 2. Transcriptional regulation:** common Aspects and differences between the transcription mediated by the three eukaryotic polymerases. Review of the characteristics of the promoter zone of DNA polymerase II. Footprint test. Activators and silencers "enhancers and silencers". Identification of gene regulatory areas. Basal transcription complex and specific transcription factors. The Mediator and SAGA complexes. Co-activators. Regulation of the transcription of RNA polymerase II. Characteristics of transcription factors. Activation domains. Regulation of the activity of the transcription factors. Methods of identification and purification of transcription factors. Methods of identification of DNA regions to which transcription factors are attached. Verification of the functionality of the pair transcription factor / regulatory sequence in vivo.

**Topic 3. Post-transcriptional regulation:** The mRNA edition, the role of the mRNA hood (CAP 5') in the translation of mRNA and its stability. The union complex in CAP (CBC) and eIF4E. Polyadenylation and its role in the translation and stability of mRNA. The histone mRNAs. Splicesosome, SR proteins and "exo-splicing-enhancers" (ESEs). Alternative splicing and trans-splicing. Regulation of alternative splicing. Coupling between RNA processing and transcription. Methods for identifying variants of alternative splicing. Editing mRNA. Regulation of the transport of mRNA. Control of the average life of mRNA and quality control. P-bodies and stress granules. Regulation elements in mRNA and regulatory proteins. Methods for determining the average life of mRNA. Regulation of translation. Post-transcriptional regulation through sRNAs (siRNA and miRNA). Regulation of the average life of proteins.

**Topic 4. Cell Signaling: Signaling Strategies.** Intercellular signals: hormones and receptors. Signaling linked to intracellular receptors. Signal transduction for plasma membrane receptors. Receptors related to G. proteins. The Wnt path. Catalytic receptors: activation of enzymatic cascades. Interaction and regulation of signal pathways. Transmission of signals from the cell surface to the nucleus: phosphorylation of target proteins. Medical applications of the study of signals and cellular communication. The Notch pathway.

**Topic 5. Control of the cell cycle:** General principles of the cell cycle. Proteins involved in regulating the progression of the cycle. Control points during the cell cycle: proteins and mechanisms involved. Control of the cell cycle by action of miRNAs. Regulation of the transcription of miRNA: role of p53 as a regulator. Apoptosis. Types of apoptotic routes: intrinsic or dependent on mitochondria and extrinsic. Apoptotic mechanism: intracellular proteolysis cascades. Role of caspases and proteins IAP and Bcl-2. Cellular aging.

**Topic 6. Cellular cancer bases.** Clonal origin of the cancerous cell and tumor progression. Conductive mutations vs. passenger mutations. Acquired capabilities of the cancer cell and its effects on: 1) cell cycle control mechanisms, 2) Invasion and metastasis, 3) Immortality, 4) Induction of angiogenesis and 5) Tumor progression. Genomic instability and mutations. Exosomes and cancer. miRNAs and cancer. Medical applications of the study of the previous mechanisms: therapies against cancer.

**Topic 7. Integration of cells in tissues.** Cell adhesion and signal transduction. Protein membrane plasmatic implicated in cell adhesion: Families. General characteristics. Family of the Cadherins. Signal transduction and cellular responses. Family of the Integrins. Regulation of adhesion and adhesion kinases. Signs via integrins. Signal transduction and cellular responses. Superfamily of the Immunoglobulins. Subfamilia N-CAM and development. Cell adhesion molecules in T. cells Family of the Selectins. Function in the migration of leukocytes. Relationship with metastasis. Proteoglycans. Structure and type. Proteoglycans membrane: regulation in the adhesion of growth factors and participation in signal transduction. Elements of Extracellular Matrix: Collagen. Fibronectin. Laminin Transcription of cell signals and responses based on the recognition of extracellular matrix elements.

**Topic 8. Stem cells:** Definition. Transient amplifier cells. Potentiality and types of stem cells. Stem cells in tissues. Studies in different tissues: Human epidermis. Follicle hair and sebaceous gland. Small intestine. Olfactory epithelium and olfactory neurons. Ciliated ear cells. Bone marrow. Muscle tissue. Adipose tissue. Nerve tissue. Regeneration of members. Generation of stem cells and therapeutic potential.