

**Control of Gene Expression in Eukaryotes**

Code: 101978  
ECTS Credits: 6

Degree	Type	Year	Semester
2500890 Genetics	OT	4	0

**Contact**

Name: Inmaculada Ponte Marull  
Email: Inma.Ponte@uab.cat

**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

**Teachers**

Maria Plana Coll  
Alicia Roque Cordova

**Prerequisites**

There are no prerequisites to follow the course successfully.

Nonetheless, it would be desirable if students were familiar with basic knowledge of Biochemistry and Molecular Biology, Genetics, Celular Biology and Animal Physiology.

**Objectives and Contextualisation**

The training objectives are that the student, at the end of the subject, will be able to:

- Describe the structural aspects of chromatin, the factors that regulate it and its role in the regulation of gene expression.
- To know the strategies used in the identification of the mechanisms for the control of the gene expression in eukaryotes.
- Describe the most significant types of transcription factors in the control of gene expression and the mechanisms that regulate them in response to intracellular and extracellular signals.
- To know the mechanisms for controlling the translation and the stability and activation of mRNAs in response to cellular demands, embryonic development and their alterations in various pathologies.
- Explain the functional interrelationship in the various mechanisms of gene expression control during proliferation, cell differentiation and embryonic development, as well as to meet energy demands in various physiopathological situations.
- Learn how to apply the knowledge studied and the information in the databases to solve quantitative and quantitative problems related to their alterations in pathological situations, especially to genetic diseases with a higher prevalence in our population.
- Know how to design experiments, including the limitations of the experimental approach, interpret the experimental results, apply the computer resources for the search of specialized information, the treatment of the data and the communication of the results to the scientific community.

## Content

### **Topic 1: Levels of control of gene expression in eukaryotes.**

Introduction. Description of the different levels of gene expression controls. Methods for their study.

### **Topic 2: Structure of chromatin**

The nucleosome. Histone variants Post-translational modifications of histones. Fiber of 30 nm. Structural and functional chromatin domains. Methylation of DNA.

**Topic 3: Rol of the chromatin structure in the control of eukaryotic gene expression.** Alterations in DNA methylation of active or potentially active genes. Modifications of histones in chromatin of active or potentially active genes (Histone Code). Chromatin structure changes in active and potentially active genes. Remodeling complexes.

**Topic 4: Control of transcription.** Transcription: control mechanisms in the formation of the initiation and elongation complex Transcription factors and control mechanisms in response to biological signals. End of transcription.

**Topic 5: Transcription factors.** Structural characteristics. General action mechanisms on transcription. Activation of transcription factors. Response models of transcription factors to intracellular and extracellular signals.

**Topic 6: Post-transcriptional processing. Transport and stability of mRNA.** Maturation of mRNA (capping / polyadenylation / splicing). Core-cytosol export of mRNAs and mechanisms that control it. Cytoplasmic distribution of mRNA: localization of translation. Storing mRNA in the cytosol and mRNA activation. Controlling the stability and degradation of mRNAs: Importance of siRNA and miRNA.

**Topic 7: Translation and mechanisms to control it.** Stages and levels of translation control. Control of translation in response to intracellular and extracellular signals: Importance of the structural elements present in the mRNA. Alternative mechanism of initiation of translation in eukaryotes and factors that control them.

**Topic 8: Post-translational control.** Control of protein stability and degradation. Factors that influence the proteome: post-translational modifications and their control.

**Topic 9: Control of gene expression in cellular development and differentiation.** Control of gene expression in embryonic development. Cell specification and control of gene expression specific to the cell type.

**Topic 10: Gene expression and cancer.** Oncogenes and tumor suppression genes: Cell mechanisms that affect their expression.

**Topic 11: Gene regulation and human diseases.** Transcription, post-transcriptional processing and human diseases. Structure of chromatin human diseases. Infectious diseases and gene expression