Universitat Autònoma de Barcelona

2018/2019

Molecular Biology and Genetics

Code: 100936
ECTS Credits: 6

Degree	Type	Year	Semester
2500253 Biotechnology	OB	2	2

Contact

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Use of languages

Principal working language: spanish (spa)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: No

Prerequisites

There are no specific official prerequisites.

Objectives and Contextualisation

This subject integrates the molecular mechanisms that occur in the processes of transmission of genetic information (replication, transcription and translation), based on the study of the three-dimensional structure of the macromolecules involved (nucleic acids, enzymes and regulatory proteins) and their interaction.

Specific objectives:

- knowing the different structures adopted by the nucleic acids, as well as the different degrees of packaging of the DNA according to the type of organism and the moment of the cell cycle.

- Understanding the function of the different RNA polymerases from their three-dimensional structure, and the mechanisms for controlling transcription depending on the type of organism.

- Knowing the structure and function of the ribosomes, the differencesbetween prokaryotes and eukaryotes, and the mechanisms for controlling translation.

- Knowing the mechanisms of replication, recombination, and DNA repair that maintain the integrity of the genetic information; As well as the epigenetic modifications that are transmitted through generations.

- Understanding the regulation of eukaryotic gene expression as a whole.

Content

THEORY CLASSES

I. Structure and packaging of DNA

I.1 Chemical structure and composition: Chemical definition. Laws of Chargaff.

I.2 Double-helix structures: B-DNA. A-DNA. Z-DNA. RNA helices.

I.3 DNA supercoiling: DNA size. Kinetics of reassociation: Cot and Rot. Super-topology. Topoisomerases and quantification of supercoiling. *E. coli* chromosome .

I.4 Eukaryotic chromosome and chromatin: Histones. First level of organization: the nucleosome. Second level of organization: the solenoid. Third level of organization: radial loops.

II. Transcription

II.1 Structure and function of prokaryotic RNA polymerase: Structure and binding to the promoter. Termination of transcription. Transcription control in prokaryotes.

II.2 Nuclear RNA polymerases and transcription control: Structure of RNA polymerase II. Promoters type I and III. Type II promoters: transcription factors, response elements, enhancers, and mediator.

II.3 Post-transcriptional modifications: Pre-mRNA processing. Pre-rRNA processing. Pre-tRNA processing.

III. Translation

III.1 The nature of the genetic code.

III.2 RNA transfer and aminoacylation: Structure of tRNA. Aminoacyl tRNA synthetases. Codon-anticodon interactions. Intergenic suppressors.

III.3 Ribosomes: Structure. Peptide synthesis: initiation, elongation and termination.

III.4 Control in eukaryotes: Inhibition / enhancement of translation initiation. RNA interference and gene silencing.

IV. Replication, recombination and repair

IV.1 The replicon: Modes of replication. DNA polymerases I and III. Helicases, binding proteins, ligases and primases. Initiation and termination of the replication in *E. coli*.

IV.2 Replication in eukaryotes: eukaryotic DNA polymerases. Telomeres and telomerases. Reverse transcriptase and retrotransposition.

IV.3 Recombination in eukaryotes: Holliday Intermediate. Proteins involved in replication. DSB modelduring meiosis.

IV.4. Repair: Defects in eukaryotic repair systems and disease.

V. Regulation of gene expression in eukaryotes

V.1 Epigenetics: Epigenetic changes in chromatin. Genomic imprinting by deletion and by trinucleotide repetition.

V.2 Retrotransposons: Elements regulating gene expression.

PROBLEM BASED LEARNING

The content of this section consists of a certain amount of problem statements related to the topics developed in the Theory classes.