

Degree programme	Type	Course
Biotechnology	OB	2

Contact lecturer

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Prerequisites

There are no specific official prerequisites.

Group languages

You can consult this information at the [end](#) of the document.

Objectives

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 differences between 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.

Learning outcomes

- CM14 (Evaluate evolutionary relationships between macromolecules based on the analysis of sequence data.) Evaluate evolutionary relationships between macromolecules based on the analysis of sequence data.
- CM15 (Work collaboratively in teams to solve problems in the field of biochemistry.) Work collaboratively in teams to solve problems in the field of biochemistry.
- KM15 (Provide a proper description of the differential regulation of gene expression in prokaryotes and eukaryotes.) Provide a proper description of the differential regulation of gene expression in prokaryotes and eukaryotes.

- SM14 (Correctly interpret data and observations in the field of biochemistry.) Correctly interpret data and observations in the field of biochemistry.

Contents

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.

I.5 Epigenetics: Epigenetic changes in chromatin. Genomic imprinting by deletion and by trinucleotide repetition.

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. Transposition, Replication, recombination and repair

IV.1 Reverse transcriptase and retrotransposition. Regulatory elements of gene expression.

IV.2 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.3 Replication in eukaryotes: eukaryotic DNA polymerases. Telomeres and telomerases.

IV.4 Recombination in eukaryotes: Holliday Intermediate. Proteins involved in replication. DSB model during meiosis.

IV.5. Repair: Defects in eukaryotic repair systems and disease.

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.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
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Theoretical sessions	30	1.2
Studying theory	50	2
PBL sessions	15	0.6
Autonomous learning	25	1
Solving problems	25	1

The training activities consist of classes of theory and classroom practices. Each of them has its own specific methodology.

Theory classes

The teacher will explain the contents of the syllabus with the support of audiovisual material that will be available to students in the Virtual Campus of the subject, in advance. These lectures will be the most important part of the theory section. It is recommended that students have the material published on the CV in printed form in order to be able to follow the classes more comfortably.

Under the guidance of the teacher, the knowledge of some parts of the syllabus will have to be deepened by the students, by means of autonomous learning. In order to facilitate this task, information about locations will be provided in textbooks, web pages, etc.

Classroom practices

There will be 15 sessions of classroom practices per group, in the data announced in the calendar. For these sessions, the theory group will be divided into two subgroups of the same size, whose lists will be made public at the beginning of the course. Students will attend the sessions programmed for their group, exceptions will not be allowed.

In these sessions, the teacher will present the experimental and calculation principles necessary to work on specific problems, explaining the guidelines for their resolution and at the same time reinforcing the knowledge of different parts of the theory classes.

Annotation: within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes
Part 2-PBL	0.125	1.5	0.06	CM15, SM14
Part 1-PBL	0.125	1.5	0.06	CM15, SM14
Part 1- Theory	3.75	1	0.04	CM14, KM15
Part 2-Theory	3.75	1	0.04	CM14, KM15

The evaluation of the subject will be carried out through a continuous assessment consisting of four assessments of two different types: two questionnaires with test questions and two probes with the resolution of two problems. Each partial test will correspond to approximately one half of the theoretical syllabus or classroom practices.

Each trial will be independent about its recovery. Those students who have not passed 40% of one or both of the test type questionnaires must complete a final recovery of the test / s not passed. With regard to problem-solving tests, the recovery is voluntary.

The recovery will also be open to any student who, despite having passed the continuous assessment, wishes to improve the grade obtained; In this case however, the corresponding proof is annulled. Honor matris will be preferentially assigned to the best grades obtained for the continuous evaluation.

To participate in the recovery, the students must have previously been evaluated in a set of activities whose weight equals to a minimum of two thirds of the total grade of the subject or module. Therefore, students will obtain the "Non-Evaluable" qualification when the assessment activities carried out have a weighting of less than 67% in the final grade. In other words, THE STUDENT MUST BE SUBMITTED TO THE 2 PARTIALS TO RECOVER THE SUBJECT.

The final grade obtained will be calculated as follows: $3.75 * \text{questionnaire-1} + 1.25 \text{ resolution problems-1} + 3.75 * \text{questionnaire-2} + 1.25 \text{ resolution problems-2}$

(*) TO PASS THE SUBJECT, IT IS MANDATORY THAT THE NOTE OF THE QUESTIONNAIRES IS SUPERIOR TO 1.5 / 3.75, AND THE GLOBAL NOTE OF 5.

This subject does not provide for the single assessment system.

"The commission of any irregularity in an assessment act (academic fraud, plagiarism or improper use of AI, unless such use is expressly authorized in the teaching guide), which may lead to a significant variation in the grade, means that this act will be graded with a 0. In the event that the teaching guide provides that in order to pass the subject it is an essential requirement to have obtained a minimum grade in this assessment act or that several irregularities occur in the assessment acts of the same subject, the final grade for this subject is 0. Apart from this, a disciplinary process may be initiated against the student who incurs any of these irregularities."

This subject does not provide for the single assessment system

Bibliography

Main Textbooks

- Biochemistry (4erd Ed, 2021) (THIRD EDITION, 2015, IN THE UAB LIBRARY IS FINE)

D. Voet & J.G. Voet Ed. John Wiley & Sons

Main Book

- Lewin's Genes XII (2017)

J.E. Krebs, E.S. Goldstein, S.T. Kilpatrick. Ed. Jones and Bartlett Learning.

Secondary book

- Biochemistry (3er Ed, 2000)

C.K. Matthews, K.E., van Holde, and K.G. Ahern. Ed. Benjamin/Cummings

Only for DNA topology.

- Gene Control (2on Ed. 2015)

D.S. Latchman. E. Garland Science

For eukaryotic gene control.

Enllaços web

Web links must be updated continuously. They will be indicated within the material presentations uploaded in the

Software

There is no specific software for this subject.

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this [link](#). To access the information, you will need to enter the course CODE

Type of teaching	Group	Language	Semester	Shift
(TE) Theory	42	Spanish	first semester	morning-mixed
(PAUL) Classroom practices	421	Spanish	first semester	afternoon
(PAUL) Classroom practices	422	Spanish	first semester	afternoon