Universitat Autònoma de Barcelona

Molecular Biology

2026/2027

Code: 100858
Credits: 6

Degree programme	Type	Course
Biochemistry	OB	2

Contact lecturer

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Group languages

You can consult this information at the end of the document.

Prerequisites

It is highly recommended have done previously the following subjects: Biochemistry I and II, Cell Biology, Genetics, and Microbiology.

Objectives

This course will focus on the structure and function of nucleic acids. The detail topics of the course are listed in the contents section. The main objective of this course is that students get knowledge on the fundamentals in chromatin structure, epigenetics, transcription and translation mechanisms in prokaryotic and eukaryotic organisms, and how the DNA is replicated and repaired. Moreover, the experimental foundations on which the different topics are based will be specifically addressed during this course.

Learning outcomes

- CM16 (Assess new methodologies and approaches in molecular biology research applied to the study of cancer.) Assess new methodologies and approaches in molecular biology research applied to the study of cancer.
- CM18 (Make an oral presentation on a topic related to molecular biology.) Make an oral presentation on a topic related to molecular biology.
- KM21 (Describe the molecular mechanisms involved in the maintenance, variability and transmission of genetic information, as well as in the regulation of gene expression.) Describe the molecular mechanisms involved in the maintenance, variability and transmission of genetic information, as well as in the regulation of gene expression.
- SM18 (Apply computing resources to visualize and understand the three-dimensional structure of proteins, search for information in databases, and use molecular tools.) Apply computing resources to visualize and understand the three-dimensional structure of proteins, search for information in databases, and use molecular tools.
- SM19 (Analyse the molecular mechanisms that regulate the function of proteins and nucleic acids, as well as their alterations in cancer.) Analyse the molecular mechanisms that regulate the function of proteins and nucleic acids, as well as their alterations in cancer.

Contents

Syllabus:

1. Genes and chromosomes.

DNA size. Supercoiling. Structure of the eukaryotic chromosome: chromatin, histones, nucleosomes. Organization at higher levels. Chromosome maintenance proteins (SMC).

2. The structure of chromatin as a mechanism for controlling gene expression.

Levels of regulation of gene expression. Methods of analysis of differential gene expression. Active chromatin and nuclease sensitivity assay. Modification of histones. Remodelling complexes. Subtypes of histones. DNA methylation

3. Prokaryotic and eukaryotic transcription.

Structure and function of prokaryotic RNA polymerase: Structure and binding to the promoter. Elongation and Termination of transcription. General principles of the regulation of gene expression: positive and negative regulation. Control of transcription in prokaryotes. Eukaryotic RNA polymerases and synthesis of the different RNAs. Other eukaryotic RNAs: miRNA, siRNA, piRNA and lncRNA. The promoter zone of RNA polymerase II and other regulatory elements. Assembly of the transcription machinery. The mediator complex. Characteristics of transcription factors.

4. Processing of eukaryotic mRNA.

Processing at the 5 'end. Splicing Processing at the 3 'end. Alternative splicing. Edition of the RNA. Mechanism of mRNA degradation. P-bodies and stress granules. Regulation of the transport and stability of eukaryotic mRNA.

5. Translation.

The genetic code. Transfer RNA and aminoacylation: Structure of tRNA. Aminoacyl tRNA synthetases. Codon-anticodon interactions. Ribosomes: Structure. Peptide synthesis: initiation, elongation and termination. Control of translation.

6. Replication, repair, recombination and transposition.

Molecular mechanism of DNA replication in prokaryotes. The replisome (helicase, RNA primase, DNA polymerases);ssDNA binding proteins;DNA ligase; topoisomerases. DNA polymerases I and III. Replication of DNA in eukaryotes: cell cycle, mechanism of replication. Reverse transcriptase and telomerase. Repair systems. Homologous DNA recombination. Transposition.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Preparation and exposition of seminars (in group)	20	0.8	CM16, CM18, KM21, SM18, SM19
Seminar sessions	10	0.4	CM16, CM18, KM21, SM18, SM19
Study, and research of information.	78	3.12	CM16, KM21, SM18, SM19
Lectures	35	1.4	CM16, KM21, SM19

The teaching activities are divided into two sections: lecturer sessions and seminar sessions, each of them with their specific methodology.

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
Second midterm exam	40%	3	0.12	CM16, KM21, SM19
Seminar assessment: presentation and attendance at the Molecular Biology Congress.	20%	1	0.04	CM16, CM18, KM21, SM18, SM19
First midterm exam	40%	3	0.12	CM16, KM21, SM19

Assessment

- Theory

The theoretical component will account for 80% of the final course grade. Assessment will be based on continuous assessment and will consist of two midterm examinations.

In order for the different assessment components to contribute to the final grade, students must obtain a minimum mark of 4.0 out of 10 in each midterm examination.

Students who obtain a mark below 4.0 in either midterm examination may retake it during the resit examination period.

- Seminars

Seminars will account for 20% of the final course grade. Assessment will consist of the preparation, presentation, and discussion of a previously assigned or agreed topic, which will be presented on the scheduled dates in a scientific conference format.

Attendance at seminars is mandatory, except in duly justified circumstances. Unjustified absences will result in a significant penalty to the final grade.

Seminar materials must be submitted to the instructor at least one week before the scheduled presentation date.

Seminars cannot be retaken or reassessed.

- Additional assessment activities not scheduled in the course calendar

Up to four short assessment activities may be conducted throughout the semester during regular lecture hours. These activities may contribute up to 1 additional point to the final course grade.

These activities will not be announced in advance and will be voluntary. Failure to complete them will not result in any penalty, but successful completion may improve the final grade.

This additional point may only be added to the final grade if the student has obtained a minimum mark of 4.0 out of 10 in each theory midterm examination. Under no circumstances may this additional point compensate for a mark below 4.0 in any midterm examination.

In the event of a tie in the final grade for the award of a Honours Distinction (Matrícula d'Honor), the tie will be resolved using the grade calculated without the additional point obtained through these assessment activities. However, the additional point will remain part of the student's final course grade.

The application of this additional point may not result in a final grade higher than 10 out of 10.

- Overall assessment

The course will be considered passed when the weighted average of all assessment activities is 5.0 out of 10 or higher.

For seminar grades and the additional point obtained through the short assessment activities to be included in the final grade, students must have obtained a minimum mark of 4.0 out of 10 in each theory midterm examination.If this requirement is not met, the maximum grade that will be recorded in the official grade report will be 4.5 out of 10.

According to UAB regulations, in order to be eligible for the resit examination, students must previously have been assessed in activities representing at least two-thirds (67%) of the final course grade.

Therefore, students who have completed assessment activities accounting for less than 67% of the final course grade will receive the designation Not Assessed.

Students who pass the course through the resit examination may obtain a maximum final grade equivalent to Excellent, but will not be eligible for the Honours Distinction (Matrícula d'Honor).

Students who have already passed the course through continuous assessment may voluntarily take the resit examination to improve their grade. In this case, they will also be ineligible for the Honours Distinction. The examination designed for grade improvement may differ from that taken by students who need to resit one or more midterm examinations.

Students who are unable to attend an individual assessment activity for justified reasons (such as illness, accident, death of a first-degree relative, or equivalent circumstances) and provide the corresponding official documentation to the course coordination team will be entitled to complete an alternative assessment, which may be oral. This assessment will be scheduled on a date agreed with the teaching staff, usually during the resit examination period.

Single Assessment

The single assessment consists of a single examination covering the contents of the entire theoretical syllabus. The examination will consist of essay questions and/or short-answer questions. The mark obtained will account for 80% of the final course grade. The single-assessment examination will take place on the same date as the second midterm examination scheduled for the continuous assessment pathway, and the same resit regulations will apply.

The assessment of the seminar activities (attendance is not mandatory for students opting for single assessment) will follow the same procedure as in the continuous assessment pathway. Students will submit the required assignment (audiovisual files) through the virtual campus on the date that will be announced at the beginning of the course. The mark obtained will account for 20% of the final course grade.

The course will be considered passed when the combined grade for theory and seminars is 5.0 out of 10 or higher. However, students must obtain a minimum mark of 4.0 out of 10 in the theory examination for the seminar grade to be included in the final calculation. Otherwise, the course will not be considered passed.

Students wishing to be assessed through this modality must formally request it at the beginning of the course.

Use of artificial intelligence (AI)

In this course, the use of AI is permitted exclusively for support tasks, such as bibliographic or information searches, text correction, or translations, always applying a selection criterion that limits sources to verified scientific texts (preferably journals indexed in PubMed or Web of Science). AI may also be used for image generation or aesthetic slide design.

Students must clearly identify which parts were generated using AI, specify the tools used, and include a critical reflection on how these tools influenced the process and final result of the activity. Lack of transparency regarding AI use in an assessed activity will be considered academic dishonesty and may result in partial or

total penalization of the activity grade, or more severe sanctions in serious cases.

Additional note: Any irregularity in an assessment activity (academic fraud, plagiarism, or improper use of AI unless explicitly authorized in the course guide) that may significantly alter the grade will result in a score of 0 for that activity. If the course guide requires a minimum grade in that activity to pass the course, or if multiple irregularities occur in the same course, the final grade for the course will be 0. Additionally, disciplinary proceedings may be initiated against the student.

Bibliography

- Latchman, D. S., & Cheriyath, V. (2025). *Gene Control* (3rd ed.)Routledge.
- Nelson, D. L., & Cox, M. M. (2021). Lehninger Principles of Biochemistry (8th ed.). W.H. Freeman.
- Voet, D., & Voet, J. G. (2021). Biochemistry (4th ed.). John Wiley & Sons

Review articles and web links available in the slides and/or on the course's Virtual Campus.

Software

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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	32	Catalan	second semester	afternoon
(PAUL) Classroom practices	321	Catalan	second semester	morning-mixed