Universitat Autònoma de Barcelona

2019/2020

Molecular Biology

Code: 100858
ECTS Credits: 6

Degree	Type	Year	Semester
2500252 Biochemistry	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

Other comments on languages

Materials will be also used in Catalan and English

Prerequisites

Part of the knowledge of the 1st and 2nd courses of the degree is needed to be able to follow the course. Some materials of the following courses are particularly needed : Biochemistry I, Biochemistry II, Chemistry and Engineering of Proteins, Basic and Advanced Instrumental Techniques, Cell Biology, Genetics, and Microbiology.

Objectives and Contextualisation

The students of the Biochemistry degree have previously acquired some descriptive knowledge of Molecular Biology. The Molecular Biology course will carry out a study in depth about the structure and function of nucleic acids. The subjects of the course are listed in the contents. The most important objective of the course is to get a good knowledge of the fundamentals and acquire the ability to assess the current state of scientific knowledge of the different subjects of Molecular Biology. For this reason, the experimental foundations on which the different subjects of Molecular Biology are based will be specifically addressed in this course. The foundations of genetic engineering will be also presented in this course, but they will be treated in detail in the course of Recombinant-DNA Technology (third year / second semester).

Competences

- Collaborate with other work colleagues.
- Define the structure and function of proteins and describe the biochemical and molecular bases of their folding, intracellular traffic, post-translational modification and replacement.
- Identify molecular structure and explain the reactivity of the different biomolecules: carbohydrates, lipids, proteins and nucleic acids.
- Interpret experimental results and identify consistent and inconsistent elements.
- Read specialised texts both in English and ones own language.
- Stay abreast of new knowledge of the structure, organisation, expression, regulation and evolution of genes in living beings.
- Use ICT for communication, information searching, data processing and calculations.

Learning Outcomes

1. Collaborate with other work colleagues.
2. Compare the molecular mechanisms involved in the perpetuation, maintenance and generation of variability in genetic information.
3. Correctly describe the structural bases of the interaction between proteins and nucleic acids.
4. Describe the differential regulation of gene expression in prokaryotes and eukaryotes.
5. Describe the molecular mechanisms of the transmission of genetic information from nucleic acids to proteins.
6. Explain the structural and dynamic polymorphism of nucleic acids.
7. Explain the structural models of DNA folding in chromosomes.
8. Indicate the capacity of the different structural analysis techniques and decide which to apply in specific experimental situations.
9. Interpret experimental results and identify consistent and inconsistent elements.
10. Interpret findings from structural studies of proteins and nucleic acids.
11. Read specialised texts both in English and ones own language.
12. Use ICT for communication, information searching, data processing and calculations.

Content

1. Genes and chromosomes.

Gene concept. 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. Remodeling 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.

Methodology

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

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Lectures	35	1.4	2, 3, 5, 4, 6, 7, 10, 9
Seminar sessions	10	0.4	12, 1, 2, 3, 5, 4, 6, 7, 10, 9, 11
Type: Supervised			
Preparation and exposition of assignments in group	20	0.8	
Type: Autonomous			
Study, and research of information.	78	3.12	12, 2, 3, 5, 4, 6, 7, 10, 9, 11

Assessment

Theory:

The total weight of the evaluation of the theoretical part will be 80% of the total mark of the subject. The main evaluation of this part of the subject will have the format of continuous evaluation with two mid-course exams. Each exam must be overcome with a minimum of 4.0 points out of 10. In case someone obtains less than 4.0, he or she will be able to reassess it in the final exam.

Seminars:

Seminars will have continuous evaluation. The weight of the seminar evaluation will be 20% of the total, and their attendance is mandatory (except in justified circumstances). The assignment must be presented to the teacher 1 week before its exposition. The use of English will be scored, corresponding up to 10% of the assignment assessment.

Seminars will not be reassessed.

Overall assessment:

The subject will be passed when the sum of the different parts weighted by their specific weight in the subject equals or exceeds 5.0 out of 10 points. The mid-term exams must be overcome with a minimum of 4.0 points out of 10 in order to add the note of seminar assignment to the overall score.

To participate in the final exam, according to UAB regulations, students must have been previously evaluated in a set of activities the weight of which equals a minimum of two thirds of the total grade of the subject. Therefore, the students will obtain the "Not Evaluable" qualification when the evaluation activities carried out have a weight lower than 67% in the final grade.

Students who must do the final exam will not be eligible for the maximum grade of honor, but may opt at most to the excellent.

Students who cannot attend an individual exam for a justified reason (such as illness, death of a first-degree relative, by accident ... etc), and provide the corresponding official documentation to the Degree Coordinator, can do the exam in a later date.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Assessment of assignments	20%	1	0.04	12, 1, 2, 3, 5, 4, 6, 7, 8, 10, 9, 11
First midterm exam	40%	3	0.12	2, 3, 5, 4, 6, 7, 8, 10, 9, 11
Second midterm exam	40%	3	0.12	2, 3, 5, 4, 6, 7, 8, 10, 9, 11

Bibliography

Lehninger: Principios de Bioquímica (2009, quinta edición). DL. Nelson y MM. Cox. Ediciones Omega.

Biochemistry (2011, fourth edition). D. Voet and JG. Voet. J. Wiley & Sons.

Molecular Biology of the Cell (2015, sixth edition). B. Alberts et al. Garland Science.

Gene Control (2015, 2nd Ed). Latchman DS, 2nd Ed. Garland Science.

Original scientific articles that will be indicated at the VC.