Universitat de Lleida

DEGREE CURRICULUM

MOLECULAR BIOLOGY

Coordination: TORRES ROSELL, JORDI

Academic year 2022-23

MOLECULAR BIOLOGY 2022-23

Subject's general information

Subject name	MOLECULAR BIOLOGY
Code	101514
Semester	2nd Q(SEMESTER) CONTINUED EVALUATION
Typology	

Degree	Course	Character	Modality
Bachelor's Degree in Biomedical Sciences	1	COMPULSORY	Attendance-based

Course number of credits (ECTS)	6
Type of activity, credits, and groups	

Activity type	PRALAB	PRAULA	TEORIA
Number of credits	0.4	2.6	3
Number of groups	3	2	1

Coordination	TORRES ROSELL, JORDI
Department	BASIC MEDICAL SCIENCES
Teaching load distribution between lectures and independent student work	H Presencials 60 H. No Presencials 90 Presencial 60 Magistral 30 Pràctica 10 Seminari 20
Important information on data processing	Consult this link for more information.
Language	Català Anglès

MOLECULAR BIOLOGY 2022-23

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
TORRES ROSELL, JORDI	jordi.torres@udl.cat	9,4	

Subject's extra information

The subject of Molecular Biology has a basic character in the Biochemical Sciences degree. The ultimate goal is to provide the student with solid knowledge on the molecular basis of gene function. These biological knowledge is complemented with those of Genetic Engineering subject, which provides the basis for the manipulation and control of gene function.

Learning objectives

The main goal is to learn the basic concepts that are essential to understand the molecular background of different types of biological processes.

Objective	Activities	Direct	Student dedication
Acquire basic knowledge about the function of genes at the molecular level.	30 lectures of 1h	30	90
Analyze the structure of DNA by electrophoresis	1 session of 4h.	4	10
Understand PCR and DNA sequencing techniques. Use and interpret human genome databases.	2 sessions of 3h.	6	15
Acquire knowledge about the main techniques of analysis in molecular biology. Integrate knowledge at a practical level by solving experimental problems and case studies. Development of questionnaires. Preparation and presentation of seminars.	10 sessions of 2h.	20	35
		60	150

* Student Dedication = Contact Hours + Student Work Hours

Competences

- CB1 That students have demonstrated that they have and understand knowledge in an area of study that is based on general secondary education, and is usually found at a level that, while supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study
- CB2 That students know how to apply their knowledge to their work or vocation in a professional way and possess the skills that are usually demonstrated through the development and defense of arguments and problem solving within their area of study
- CE44. Describe the structure, properties, and levels of organization of DNA and RNA.
- CE45. Define the molecular bases and mechanisms of the flow of genetic information and its regulation.
- CE57. Apply and evaluate electrophoretic methods for the separation of proteins and nucleic acids
- CE59. Apply techniques of luminometry, cytometry, chromatography and spectrometry.
- CE60. Apply the basic methods of Molecular Biology used in biomedical research

Subject contents

Topic 1. Nucleic acids and genome complexity

1.1. Nucleotides and their components

1.2. Basic structural forms of DNA

1.3. Supercoiling and topoisomerases

1.4. RNA elements, structure and functional types

1.5. Basic aspects of the concept of gene at the molecular level

1.6. Genome complexity levels

1.7 DNA electrophoresis. DNA analysis by Southern blot

Topic 2. Chromatin

2.1 Organization of prokaryotic and eukaryotic chromosomes

2.2 Nucleosome and chromatin

2.3 Modifications of histones and epigenetics

2.4 Structure and condensation of chromosomes

Topic 3. DNA replication

3.1. Basic mechanisms of DNA replication

3.2. Elongation and replication fork

3.3. Initiation and origins of replication

3.4. Termination and maintenance of telomeres

3.5. Control of the cell cycle in eukaryotes

Topic 4. Modification of genetic information.

3.1. Recombination and transposition

3.2. Mutations: types and causal agents

3.3. Repair mechanisms

Topic 5. Transcription of genes

5.1. The flow of genetic information

5.2. Basic concepts and phases of transcription

5.3. Transcription in prokaryotes

5.4. Transcriptional regulation in prokaryotes: the lac operon

5.5. General and specific transcription factors in eukaryotes

5.6. Structural basis of DNA sequence recognition by proteins

5.7. Regulation of specific transcription factors in eukaryotes

5.8. DNA methylation and transcriptional regulation

Topic 6. RNA processing

6.1. Mechanisms of removal of introns

6.2. Alternative splicing

6.3. Functional and evolutionary implications of introns

6.4. Modifications of RNAs at 5 'and 3'

Topic 7. Translation of genes

7.1. Basics of the genetic code

7.2. tRNAs: code interpreters

7.3. Translation: phases and molecules involved

7.4. Codon-anticodon recognition on the ribosome

7.5. Translation level regulation

PRACTICAL LABs and SEMINARS

1. Laboratory practice of DNA structure analysis by agarose electrophoresis.

2. Computer room sessions: access to databases of genomes, applications, sequencing and PCR design.

3. Solving experimental problems.

4. Techniques in Molecular Biology

5. Preparation of seminars in Molecular Biology. Tutoring and presentation of concepts in team

6. Elaboration of questionnaires in team, discussion of answers in class

Methodology

The methodology used for each of the objectives of the course is as follows:

Acquire basic knowledge about the function of genes at the molecular level: 30 theory classes of 1h (single group)

Laboratory practices: 4h per group in the laboratory

Understand PCR techniques and DNA sequencing. Use and interpret the human genome databases: 2 sessions of 3 hours per group in the computer room

Integrate knowledge at a practical level by solving experimental problems and practical cases: 10 sessions of 2 hours per group in seminars.

Development plan

Part of the subject is developed in lectures (1 hour of duration). These concepts are reinforced in problem sessions and seminars in groups of 20 in which specific and applied cases are discussed. Laboratory practices are used to analyze the structure of circular and linear DNA, using restriction enzymes and topoisomerases. The computer sessions will address access to model genome databases and the design of oligonucleotides for PCR.

The following activities will be scheduled to achieve the objectives and acquire the assigned competencies:

TEO Nucleic acids and genome complexity 5h

TEO DNA replication 5h

TEO Modification of genetic information 6h

TEO Gene transcription 5h

TEO RNA processing 2h

TEO Gene translation 7h

INF Online applications and the human genome 6h

LAB DNA analysis by PCR and electrophoresis 4h

QUE Preparation of team questions, discussion of answers in class 6h

SEM Tutoring and presentation of concepts in groups 6h

PRO Problem solving / case study 8h

TOTALS 60h

Evaluation

The assessment will consist of two partial exams, the presentation of several practical exercises and oral presentations. The details of how the assessment will be structured will be detailed each year in the subject introduction document, which can be found in the resources section of the virtual campus. As a guideline, each type of exercise will count for the following percentage in the final grade:

- Partial 1: from 30 to 40%.

- Partial 2: from 40 to 50%

- Presentations in seminars and tests in the computer room: from 10 to 30%.

To pass the subject, you must have an overall grade above 5.

Bibliography

Alberts B, et al. (2007), Molecular Biology of the Cell. Garland Science

Horton R, et al. (2006), Principles of Biochemistry Pearson/Prentice Hall

Lewin B (2007), Genes IX. Jones & Bartlett

Nelson DL and Cox MM (2004) Lehninger Principles of Biochemistry. Freeman

Stryer L, et al. (2007), Biochemistry. Freeman

Watson JD, et al. (2008), Molecular Biology of the Gene. Benjamin-Cummings

Journal of visualized Experiments (JOVE)-Science Education Collection.

BioROM