UAB
Universitat Autònoma de Barcelona

Molecular Biology Techniques

Code: 102881
ECTS Credits: 3

2025/2026

Degree	Type	Year
Medicine	OT	2

Contact

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Teachers

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Teaching groups languages

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

Prerequisites

It is necessary that the student has achieved some basic competences in Cell Biology, Biochemistry and Molecular Biology, and especially a sufficient knowledge about the structure and functions of DNA and proteins.

Objectives and Contextualisation

The course aims to introduce the student to the basic mechanisms of recombinant DNA technology, with the aim of having a general view of the possibilities offered by these techniques in medicine. The Recombinant DNA Techniques have brought the possibility of applying different methods and strategies for the treatment of multiple pathologies. For example, it has allowed mass production of molecules of therapeutic interest such as insulin, growth hormone, etc. It has also allowed the development of techniques for the molecular diagnosis of pathologies. And finally, it allows the possibility of offering a cure to many diseases through the use of cell and / or gene therapy, which will surely lead to an enormous development of regenerative medicine in the coming decades. The content of the subject will allow to have knowledge of the bases that are behind the enormous possibilities that the application of these techniques has in their future medical practice.

Competences

- Communicate clearly, orally and in writing, with other professionals and the media.
- Critically assess and use clinical and biomedical information sources to obtain, organise, interpret and present information on science and health.

- Demonstrate an understanding of the fundamentals of action, indications, efficacy and benefit-risk ratio of therapeutic interventions based on the available scientific evidence.
- Demonstrate basic research skills.
- Demonstrate understanding of the basic sciences and the principles underpinning them.
- Demonstrate understanding of the importance and the limitations of scientific thought to the study, prevention and management of diseases.
- Demonstrate understanding of the manifestations of the illness in the structure and function of the human body.
- Demonstrate understanding of the mechanisms of alterations to the structure and function of the systems of the organism in illness.
- Demonstrate understanding of the organisation and functions of the genome, the mechanisms of transmission and expression of genetic information and the molecular and cellular bases of genetic analysis.
- Design and manage programmes and projects in the field of health.
- Formulate hypotheses and compile and critically assess information for problem-solving, using the scientific method.
- Indicate the basic diagnosis techniques and procedures and analyse and interpret the results so as to better pinpoint the nature of the problems.
- Maintain and sharpen one's professional competence, in particular by independently learning new material and techniques and by focusing on quality.
- Use information and communication technologies in professional practice.

Learning Outcomes

1. Acknowledge the importance of research to medical progress.
2. Analyse information from biological sequencing.
3. Apply the basic principles of the scientific method (observation of phenomena, hypothesis formulation and testing of hypotheses) to the diagnosis, treatment and prevention of human diseases.
4. Assess the need, indications, costs and risk-benefit ratio of molecular techniques for microbiological or cytological diagnosis.
5. Communicate clearly, orally and in writing, with other professionals and the media.
6. Critically evaluate the main sections of a clinical research paper.
7. Critique scientific papers on bioinformatics.
8. Demonstrate basic research skills.
9. Describe the diagnosis, prognosis, prevention and treatment for the most common genetic pathologies in the human population.
10. Describe the indications of anatomopathological tests.
11. Describe the indications of biochemical tests used in the diagnosis of genetic diseases.
12. Describe the main biomedical bibliographic databases and filter the information provided.
13. Describe the molecular basis of the mechanisms underlying anatomopathological alterations of various diseases, primarily neoplastic and hereditary ones, in different body systems.
14. Describe the principles of the scientific method and their application to experimental work.
15. Design a basic research project on the basis of a hypothesis and a set of objectives.
16. Discuss the results of a research project.
17. Formulate hypotheses and compile and critically assess information for problem-solving, using the scientific method.
18. Identify the concept of medical bioinformatics and the integration of genetic and clinical databases.
19. Identify the immunohistochemical, cytogenetic and molecular biology markers of importance in cytological diagnosis.
20. Identify the molecular basis of the main genetic diseases with a biochemical translation.
21. Identify the most efficient molecular biology tests for prevention, diagnosis and control of treatment for the most common human pathologies.
22. Identify the most efficient tests for prevention, diagnosis and control of treatment for the most common human pathologies.
23. Identify the semiological value of laboratory tests used in the most common human pathologies.
24. Interpret research results and their application to clinical practice.
25. Know good practice in science and identify scientific fraud.

26. Maintain and sharpen one's professional competence, in particular by independently learning new material and techniques and by focusing on quality.
27. Make deductions on the basis of experimental findings.
28. Obtain appropriately the clinical samples needed for molecular tests for microbiological or cytological diagnosis.
29. Relate genetic dysfunction to the pathological phenotype.
30. Use information and communication technologies in professional practice.

Content

The contents of the subject are structured in 6 blocks:

1.- General concepts about the structure and function of proteins and nucleic acids.

In this block, the general concepts about the structure and function of nucleic acids and proteins will be explained. This is a block that aims to review concepts that students must have already seen in various core subjects of the first year: levels of structure of proteins and nucleic acids, how the flow of genetic information occurs in cells and what are the main mechanisms of regulation of gene activity. With this, we make sure that these basic concepts are well established in all students.

2.- Recombinant DNA techniques.

In this block, students will know the theoretical and practical elements (through laboratory practices) to generate recombinant DNA. Among them, the obtaining of DNA fragments by the use of restriction enzymes; the binding of DNA fragments using the enzyme DNA ligase; the vectors that are used to introduce the DNA into the cells or organisms and what are the possible mechanisms to introduce the foreign DNA into the host cells; how can we detect the clients that carry the gene we have introduced, and how can we clone a gene or DNA fragment?

3.- Production of molecules of medical interest by recombinant DNA.

In this block, students will know the methods used to obtain molecules of medical interest through molecular biology. We will see the examples of obtaining recombinant insulin, recombinant growth hormone, vaccines, interferons, etc.

4.- Molecular diagnosis.

The fourth block is dedicated to the application of molecular biology techniques to the diagnosis of pathologies. The students will know how, from the property that the nucleic acids have to hybridize when they have complementary sequences, several strategies have been designed that allow the diagnosis of diseases. Special emphasis will be placed on those that are commonly used in hospital analysis laboratories and students will also be illustrated with the importance that these techniques have in forensic medicine.

5.- Gene and cell therapy.

In this block, the underlying methodology in cellular and gene therapy will be discussed. Not only the techniques for the production of stem cells will be treated, but also the methods that allow us to genetically modify these cells. We will also see the aspects that still limit the clinical use of these techniques, as well as legal and bioethical aspects. Students will also know the fundamental concepts and goals of gene therapy. The difference between ex vivo and in vivo gene therapy, as well as the current status of gene therapy, will be explained. Your promises and realities For this, we will analyze concrete cases of successes and failures in the use of this technology.

6.- Use of genetically modified animals in biomedical experimentation.

Finally, the last block is intended for genetically modified animals and their medical interest. The students will know the basic methods that allow generating a transgenic animal or a null mutant and will explain the interest

that these animals have as experimental models for the study of human pathologies and for the production of substances of medical interest.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
LABORATORY PRACTICES (PLAB)	9	0.36	2, 3, 6, 5, 25, 27, 8, 9, 13, 14, 10, 11, 15, 18, 23, 19, 20, 21, 22, 24, 28, 29, 30, 1, 4
SPECIALIZED SEMINARS (SEM)	6	0.24	2, 3, 6, 25, 7, 27, 9, 13, 11, 12, 16, 15, 18, 21, 22, 24, 28, 29, 30, 1, 4
THEORY (TE)	11	0.44	2, 3, 6, 25, 27, 13, 14, 10, 11, 15, 18, 23, 19, 20, 21, 22, 24, 26, 28, 1, 4
Type: Autonomous			
ELABORATION OF WORK / PERSONAL STUDY / READING OF ARTICLES / REPORTS OF INTEREST	46	1.84	2, 3, 6, 25, 7, 27, 8, 9, 13, 14, 10, 11, 12, 16, 15, 17, 18, 23, 19, 20, 21, 22, 24, 26, 28, 29, 30, 1, 4

The subject is based on a theoretical-practical 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

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Assistance and active participation in class and seminars including completing tasks in groups	40%	0.8	0.03	3, 6, 5, 25, 7, 27, 8, 14, 11, 12, 16, 15, 17, 20, 24, 26, 28, 1, 4
Evaluations written through objective tests. Do not test	40%	1	0.04	2, 3, 5, 25, 27, 8, 9, 13, 14, 10, 11, 12, 16, 17, 18, 19, 20, 21, 22, 26, 29, 30, 1
Laboratory practice evaluation	20%	1.2	0.05	2, 3, 5, 27, 8, 9, 11, 12, 16, 15, 17, 18, 23, 20, 21, 26, 29, 1

In addition to the theoretical exam (40% of the final grade), the student will have to perform laboratory practices, where he will perform the complete process of cloning a gene in bacteria and its expression in

eukaryotic cultures. For the evaluation, the dossiers of practices and the attitude in the laboratory will be taken into account. This part will represent 20% of the final grade. A recovery exam of the theoretical part will be scheduled for students who want to upload the note of this part.

40% will come from the assessment of problem and case solving classes. It will be assessed if the student has correctly performed the exercises that have been proposed throughout the course. The students will have to deliver the resolution of them on the agreed days.

The absence to more than one day of practices will prevent the qualification of that part of the subject. Failure to complete the exercises will prevent the qualification of this part of the subject.

Students who do not take the theoretical and practical assessment tests will be considered as not evaluated and will exhaust the rights to the registration of the subject.

This subject do not allow a single evaluation process

Bibliography

Human Molecular Genetics. Strachan T and Read AP (2018) 5th edition. Garland Science.

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Traducción al castellano de la Sexta edición (2016). Editorial Omega

Molecular Biology of the Gene. JD Watson, TA Baker, et al

(2013) 7th edition. Benjamin Cummings.

(2016) traducción al castellano. Editorial Médica Panamericana

Molecular Biotechnology. Principles and applications of Recombinant DNA Glick BR & Patten CL (2022) 6th edition. Editorial Wiley

Accesible a traves de https://ebookcentral-proquest-com.are.uab.cat/lib/uab/home.action

Software

No need for specific software

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PLAB) Practical laboratories	101	Catalan	second semester	morning-mixed
(PLAB) Practical laboratories	102	Catalan	second semester	morning-mixed

(SEM) Seminars	101	Spanish	second semester	morning-mixed
(SEM) Seminars	102	Spanish	second semester	morning-mixed
(TE) Theory	101	Spanish	second semester	morning-mixed