

**Laboratory III**

Code: 100978  
ECTS Credits: 3

Degree	Type	Year	Semester
2500502 Microbiology	OB	2	1

**Contact**

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**Use of languages**

Principal working language: catalan (cat)  
Some groups entirely in English: No  
Some groups entirely in Catalan: Yes  
Some groups entirely in Spanish: No

**Prerequisites**

It is desirable to have coursed or are coursing first semester of the second year of the Degree of Microbiology and the previous integrated laboratory I and II courses.  
It is mandatory that the student has passed the safety and biosafety tests that will be found in the Virtual Campus. It is also compulsory to know and accept the operating rules of the teaching laboratories of the Faculty of Biosciences and accomplish all the specific instructions of the teachers.

**Objectives and Contextualisation**

This course introduces students to basic molecular and immunological techniques for experimentation in a Molecular Biology laboratory.

The specific objectives to be achieved are defined in the following points:

- Know how to apply fractionation techniques and biochemical analysis.
- Perform nucleic acid extraction and electrophoresis techniques.
- Know how to use basic recombinant DNA techniques such as restriction endonucleases, DNA cloning in vectors, DNA transformation, etc.
- To know the methodologies for the labeling of DNA probes and to apply specific detection techniques of these probes labeled by DNA-DNA hybridization.
- Use and know how to apply PCR techniques and / or quantitative PCR.
- Know how to use immunological techniques of precipitation and agglutination or ELISA and understand their application in the identification and typing of microorganisms.
- Integrate knowledge of molecular biology, biochemistry, microbiology and immunology for the cloning, overexpression, purification and detection of a bacterial protein.

**Skills**

- Adapt to new situations.
- Apply knowledge of theory to practice
- Communicate orally and in writing.
- Design and apply methods and strategies for isolating and selecting new microorganisms and for genetically manipulating microorganisms of interest.
- Develop creativity and initiative.
- Display a capacity for analysis, synthesis, organisation, planning and decision-making.

- Use molecular and immunological techniques in the characterisation of microorganisms and materials of biological origin.
- Work individually or in groups, in multidisciplinary teams and in an international context.

## Learning outcomes

1. Adapt to new situations.
2. Apply electrophoretic techniques for separating DNA and proteins.
3. Apply knowledge of theory to practice
4. Apply methodologies for detecting and analysing different metabolites in biological preparations.
5. Apply procedures based on the use of specific probes and on hybridisation with nucleic acids.
6. Apply procedures for purifying gene products produced by microorganisms.
7. Apply suitable methods for analysing enzyme activity.
8. Communicate orally and in writing.
9. Describe and apply procedures and techniques for cloning DNA.
10. Describe and apply techniques for extracting whole DNA, chromosomal DNA, plasmidic DNA and virus DNA.
11. Describe and use immunological techniques.
12. Describe and use techniques for amplifying DNA.
13. Develop creativity and initiative.
14. Display a capacity for analysis, synthesis, organisation, planning and decision-making.
15. Interpret the results obtained when using different molecular techniques.
16. Process tissues and cells to obtain sub-cellular fractions and characterise these biochemically.
17. Use enzymes of molecular biology to modify DNA and describe the procedures.
18. Use microbial vectors for the expression of genes of interest in microorganisms.
19. Use the advanced instruments and methodologies of a biochemistry laboratory.
20. Use the basic techniques for handling and analysing proteins and nucleic acids
21. Work individually or in groups, in multidisciplinary teams and in an international context.

## Content

The subject will be organized in two distinct parts:

- **Monographic methodological sessions** lasting approximately three and four hours depending on each session and scheduled weekly in 3 groups of 3 or 4 sessions depending on each module.
- **Integrated practice**, lasting 19-hour that will be intensive for one week

### Monographic sessions

#### MODULE 1

Sessions 1, 2 and 3. Cell fractionation and biochemical analysis techniques. Characterization of the fractions for enzymatic markers. Cold marking techniques of probes, dot blot and hybridization.

#### MODULE 2

Sessions 4 and 5. Nucleic acid and restriction techniques.

Session 6. PCR techniques and quantitative PCR.

Session 7. Techniques for detecting interactions between DNA and protein.

#### MODULE-3

Sessions 8 to 11. Precipitation of immunoglobulins with ammonium sulfate. Determination of the concentration of antibodies in serum by ELISA. Separation of splenocits by density gradient. Determination of phagocytosis by a monocyte cell line using the flow cytometry technique.

### INTEGRATED PRACTICE

Session 0. Introductory theoretical session to integrated practice.

Sessions 1 and 2. Cloning of a bacterial gene and overexpression of the gene product.

Session 3. Purification and quantification of the protein.

Sessions 4 and 5. Detection of the protein by Western blot.

## Methodology

The subject will be taught in small groups of students.

To be able to acquire the specific competences of the subject attendance to the practical sessions is mandatory. In case a student for justified and unforeseeable reasons, does not attend to a practice session(s), he / she must communicate to the responsible teacher and present the corresponding certificate as soon as possible to the coordinator of the Degree. It is understood for justified cause health problems (it must be accompanied by the corresponding medical certificate) or serious personal problems, as defined in the evaluation regulations of the Faculty of Biosciences (section 1.3).

The students will have a practice manual of the course before the beginning of the practical sessions. The student must bring his own gown, laboratory glasses, a notebook, and the practice manual (available in the Virtual Campus or where indicated by the teacher staff).

The students will work in small groups. At the beginning of each session the teacher will make a brief theoretical explanation of the content of the practice and the experiences to be carried out.

In order to achieve a good performance and acquire the competences corresponding to this course it is essential that the student makes a comprehensive reading of the practice manual, familiarizing with the practices that will be carried out in each session as well as with the methodology that should apply in each case.

## Activities

Title	Hours	ECTS	Learning outcomes
<b>Type: Directed</b>			
Classroom sessions	2	0.08	1, 3, 7, 4, 5, 2, 10, 12, 11, 13, 15, 16, 8, 21, 19, 14, 17, 20
Laboratory sessions	56	2.24	1, 3, 7, 4, 5, 6, 2, 9, 10, 12, 11, 13, 18, 15, 16, 8, 21, 19, 14, 17, 20
<b>Type: Supervised</b>			
Tutorship	1	0.04	1, 3, 7, 4, 5, 6, 2, 9, 10, 12, 11, 13, 18, 15, 16, 8, 21, 19, 14, 17, 20
<b>Type: Autonomous</b>			
Comprehensive reading of the practice manual	3	0.12	1, 3, 7, 4, 5, 6, 2, 9, 10, 12, 11, 13, 18, 15, 16, 8, 21, 19, 14, 17, 20
Study	3	0.12	1, 3, 10, 12, 11, 13, 15, 21, 14
Writing reports or questionnaires	3	0.12	3, 7, 4, 5, 6, 2, 9, 12, 18, 15, 16, 8, 19, 17

## Evaluation

The evaluation of the subject is continuous and distributed in the different sections:

### MODULE 1:

The evaluation is done through a questionnaire referred to sessions 1, 2 and 3. This questionnaire will be given compulsory when indicated by the teaching staff. To overcome this module the score obtained in the

questionnaire must be equal to or greater than 5.

#### MODULE 2:

A questionnaire is made at the end of the sessions regarding the concepts discussed. The questionnaire allows to assess if the student has reached the competences associated with the module. To overcome this module the obtained score in the questionnaire must be equal to or greater than 5.

#### MODULE 3:

This module is evaluated by conducting a questionnaire at the end of session 12. To overcome this module the score obtained in the questionnaire must be equal to or greater than 5.

#### INTEGRATED PRACTICE:

The assessment of integrated practice is composed by two distinct aspects:

A) The qualification obtained in a questionnaire that each group performs after the practical part has finished. With a maximum score of 8 points out of 10.

B) The achievement in the laboratory of the objectives set in each session. With a maximum score of 2 points out of 10.

To pass this module, the final mark must be equal to or greater than 5.

#### PRIOR KNOWLEDGE OF ACTIVITIES TO PRACTICAL SESSIONS:

This section takes into account the prior knowledge of the students before beginning the practical session that derives from the previous comprehensive reading of practice manual. The evaluation is done using random questionnaires that will be delivered at the beginning of some / some session Practice. The final grade of this section is the average grade of the different tests carried out.

The final grade of the subject is the weighted average of the grades obtained in each of the different sections taking into account that each module will represent 20% of the final grade of the subject and the integrated practice will correspond to 30%. The remaining 10% depends on the qualification obtained in the previous knowledge section.

Note that it is possible to penalize with a maximum of 40% with respect to 100% of the final mark of the subject incorrect attitudes of the student in the laboratory such as lack of punctuality, not performing autonomous work (outside the sessions ) Indicated by the teacher, non-respectful behavior with colleagues or teachers, improper use of laboratory equipment and equipment, etc.

To pass the course you must obtain a final grade equal to or greater than 5, being necessary to overcome each of the modules and the integrated practice.

Students who do not pass the evaluation of the different modules or the integrated practice should perform the scheduled second chance examination at the end of the semester, opting for a maximum score of 8 points on the 10 possible of the recovered module (s).

Students who do not obtain the minimum qualification required to pass each of the modules of the integrated laboratory, will not approve the subject. In this case, the maximum final grade of the subject will be 4.

From the second enrollment, the students can even be evaluated the concrete non-passed modules. The students should contact the coordinator of their pending module (s). In the case they pass the module(s) in this new enrollment, the final grade of the course will be the weighted average of the grades of the passed module(s) in this academic year with the marks of passed module(s) in previous registrations. In case of not overcoming the module(s), the maximum final grade of the subject will be 4.

Since attendance to the scheduled activities is mandatory, the absence to any of them must be justified and communicated to the coordinator of the Degree as defined in the Methodology section. To be able to pass the subject requires a global attendance of at least 80% of the sessions scheduled and obtain the minimum score set for each module. ``

When attending less than 20% of scheduled sessions the grade will be non evaluated.

## Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Integrated practice	30%	2	0.08	1, 3, 5, 6, 2, 9, 12, 11, 13, 18, 15, 8, 21, 19, 14, 17, 20
Module 2	20%	2	0.08	1, 3, 2, 9, 10, 12, 13, 15, 8, 21, 14, 17, 20
Module 3	20%	1	0.04	1, 3, 5, 11, 13, 15, 8, 21, 14

Module1	20%	1	0.04	1, 3, 7, 4, 13, 15, 16, 8, 21, 19, 14, 20
Prior knowledge of activities to practical sessions	10%	1	0.04	3, 8, 14

## **Bibliography**

Students will have a practice manual of the course that details the objectives of each session along with the protocols that will be used. Also in the dossier, will be recorded the bibliography associated to each one of the different sessions.