

**Laboratory V**

Code: 100976  
ECTS Credits: 3

Degree	Type	Year	Semester
2500502 Microbiology	OB	3	1

**Contact**

Name: Esther Julián Gómez  
Email: Esther.Julian@uab.cat

**Use of languages**

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

**Teachers**

Maria Pilar Cortés Garmendia  
Laia Guardia Valle  
Jesús Aranda Rodríguez

**Prerequisites**

There are no official prerequisites, however:

- Students are advised to review the scientific-theoretical contents on which this subject is based.
- It is convenient to be attending simultaneously or has taken the subjects of Clinical Microbiology, Food Microbiology, and Molecular Microbiology.
- The student must have passed the safety and biosecurity tests in the laboratories. The test is answered in the corresponding educational space of the UAB intranet. The pdf documents generated when passing the tests must be delivered to the teacher on the first day of class. The student needs to be informed and to accept the rules of operation of the laboratories of the Faculty of Biosciences.
- It is essential to wear a coat and safety glasses. If not, the student will not allow access to the laboratory.

**Objectives and Contextualisation**

This is a compulsory subject of the Microbiology Degree, which introduces students both in the use of a set of analytical techniques in the field of health and food as in the genetic manipulation of microorganisms and in the application of microbiology of other molecular techniques associated with the subject of Molecular Microbiology.

The specific training objectives to achieve from this subject are the following:

- Application of different techniques for the isolation and/or identification of indicator and pathogenic microorganisms in the clinical, food and plant health field.

- To know how to apply methodologies for the incorporation of exogenous DNA into bacteria.
- To understand the use of different microbial vectors and their application in genetic manipulation and the study, at the molecular level, of microorganisms.
- Knowing processes of mutagenesis and recombination to obtain new bacterial strains.
- To use tools based on genetic fusions for the quantification of the expression of bacterial genes or for the determination of the interaction between two proteins.
- To increase the autonomy of the student within a Microbiology laboratory and his/her capacity for the experimental design of processes aimed to solve a proposed problem, thus integrating all the theoretical and practical knowledge acquired.

## **Skills**

- Apply knowledge of theory to practice
- Assess the quality and/or microbiological safety of foods, water, drugs, cosmetics and other natural or artificial products.
- Characterise the causal agents of microbial diseases in humans, animals and plants in order to diagnose and control them, perform epidemiological studies and be aware of present-day problems with these diseases and strategies to combat them.
- Design and apply methods and strategies for isolating and selecting new microorganisms and for genetically manipulating microorganisms of interest.
- Design experiments and interpret the results
- Develop creativity and initiative.
- Know and apply safety and quality regulations in microbiology.

## **Learning outcomes**

1. Apply direct-examination techniques to identify pathogenic protozoa and fungi.
2. Apply filtering techniques to detect and quantify microorganisms in contaminated samples.
3. Apply knowledge of theory to practice
4. Apply molecular techniques for studying the gene expression of microorganisms.
5. Apply most-probable-number methods to detect and quantify microorganisms in contaminated samples.
6. Apply the necessary conditions for working safely with pathogenic microorganisms.
7. Apply the techniques of diagnosis based on immunological methods.
8. Apply the techniques of diagnosis based on molecular methods.
9. Build and use genotheques.
10. Describe and apply methods and strategies for isolating and selecting microorganisms.
11. Design experiments and interpret the results
12. Develop creativity and initiative.
13. Interpret and apply protocols and procedures for microbiological analysis, based on specific regulations in different industrial sectors.
14. Know and apply safety and quality regulations in microbiology.
15. Know the chromatographic techniques and apply them to the identification of bacteria.
16. Perform and interpret studies on the sensitivity of pathogens to antimicrobial agents.
17. Take samples of contaminated materials to be analysed in the laboratory.
18. Use diagnostic procedures based on the detection of microbial antigens.
19. Use microbial vectors to manipulate microorganisms genetically.
20. Use procedures for incorporating exogenous DNA into microorganisms.
21. Use specific culture media to detect pathogenic microorganisms and microorganisms that are indicators of contamination.
22. Use strategies for obtaining and selecting mutants.
23. Use suitable methodologies for determining the presence of antiviral antibodies in a sample.
24. Use suitable methodologies for the epidemiological monitoring of pathogen strains.
25. Use the classical methodologies for isolating and identifying pathogenic bacteria.

## **Content**

The subject is organized in two different modules that are carried out intensively according to the detailed schedule showed in the calendar of the Microbiology degree (UAB intranet).

The contents of each of the two modules are the following:

### **Analytical Module**

- Serological techniques for the diagnosis of infectious diseases
- Chromatographic tools for the identification of microorganisms
- Molecular methods for the identification of pathogens
- Diagnosis of parasitic infections
- Antimicrobial sensitivity test
- Study of fungi (recognition of fungi of biosanitary interest, food, etc.)
- Food safety: detection of indicators and pathogens

### **Molecular Module**

The molecular module is organized in two parts including different content and methodology.

#### **SECTION I: Practical sessions**

Duration: 5 sessions. This section allows the student to know the basic techniques of DNA transfer in bacteria, mutagenesis mechanisms commonly used for the genetic modification of prokaryotes and procedures that facilitate the study and determination of gene expression and its regulation in bacteria. All these contents will be grouped in 3 practices that are listed below.

Practice 1: Construction of a bacterial vaccine

Practice 2: Application of genetic fusions with gene indicators for the study of gene expression

Practice 3: Random mutagenesis by using transposons

#### **SECTION II: Autonomous resolution of a practical case**

Duration: 4 sessions. In this case, the student will design and execute autonomously, under the supervision of the teacher, an experimental procedure to solve a practical case.

## **Methodology**

The subject will be taught in the laboratory and in small groups of students.

For each session is mandatory for the student to bring their own lab coat, lab glasses and the Guide that will be available on the UAB intranet or where the teacher indicates. The student also has to bring a notebook with sewed sheets, where each student will write down the observations made.

The students will have Guide of the subject before starting the classes. In order to achieve good performance and acquire the competences corresponding to this subject, it is essential that the student makes a comprehensive reading of the subject's Guide, familiarizing with the practices that will be carried out in each session as well as with the methodology that will be applied in each case.

At the beginning of each session, the teacher will make a brief theoretical explanation of the content of the practice and the experiments to be carried out by the students, as well as the specific security and biosafety measures and the treatment of the different chemical and biological waste generated.

In the case of Section II of the Molecular Module, the methodology of the puzzle will be applied. The students will receive at the beginning of the course the bibliography necessary for the resolution of the practical case. Working groups and expert groups will be established. In this section the students, under the supervision of the teachers, will define the activities to be carried out to solve the cases raised.

## Activities

Title	Hours	ECTS	Learning outcomes
<b>Type: Directed</b>			
Laboratory introduction	1	0.04	
Practical sessions	49	1.96	3, 6, 1, 7, 8, 5, 2, 4, 9, 14, 15, 10, 18, 20, 16, 13, 17, 22, 23, 24, 25, 21, 19
<b>Type: Supervised</b>			
classroom supervision	3	0.12	12, 11
<b>Type: Autonomous</b>			
Reading of the practices Guide	2	0.08	6, 1, 7, 8, 5, 2, 4, 9, 15, 10, 18, 20, 16, 13, 17, 22, 23, 24, 25, 21, 19
Study	7.5	0.3	3, 6, 1, 7, 8, 5, 2, 4, 9, 15, 10, 11, 18, 20, 16, 13, 17, 22, 23, 24, 25, 21, 19

## Evaluation

The evaluation of the subject will be continued. Each of the modules will represent 50% of the final mark of the subject. The specific assessment of each module will be done in the following way:

### Analytical module

The evaluation of the analytical module will be carried out in two different parts:

Assessment SECTION I: Individual presentation of a technical report about the work carried out (45% of the final score of the module). The report will assess the ability to integrate concepts (application of theoretical knowledge in practice), experimental design, interpretation of the results obtained and the capacity for synthesis. Each of these parameters will represent 25% of the report's note. The report must be submitted the week after the end of the sessions of SECTION I. Also in this section, the work carried out in the laboratory will be considered: autonomy, the initiative at work and the ability to work in conditions of safety, biosafety and quality in Microbiology (5% of the note in SECTION I).

Assessment SECTION II: Individual written multiple-choice test and/or short questions (45% of the final score of the module). The written test will be done on the last day of practices of the first week of the module. The other 5% of the qualification in SECTION II will consider the work done in the laboratory: autonomy, initiative at work and the ability to work in conditions of safety, biosafety and quality in microbiology.

In addition, the attitude of the student in the laboratory will be evaluated, punctuality, material previously worked at home by the student, as well as his/her work in the laboratory. This evaluation can mean a penalty of up to 20% compared to 100% of the final mark of the analytical module.

To pass this module, it will be necessary to pass each section with a score equal to or greater than 5. Students who do not pass one or both of the module's assessments can retrieve them on the scheduled date at the end of the semester by performing a written test.

### **Molecular module**

The evaluation of the molecular module will be carried out in two differentiated parts

Assessment SECTION I: In the evaluation of this section, two aspects will be taken into account, on the one hand, the qualification obtained in a test that each group will perform during the last session and that will represent 35% of the final mark of the module. On the other hand, the achievement of the goals scored and the work done in each of the sessions will be valued, representing this part 15% of the total module.

Assessment SECTION II: In this section, 10% of the total module will be determined by the achievement of the marked objectives and the work done in the laboratory. Another 10% will correspond to an oral test to be held in the last practical session. The remaining 30% will correspond to the completion of a report on the resolution of the practical case. The delivery of the report is mandatory and will take place at the end of the following week after the conclusion of the section II sessions. The performance of the report must follow the guidelines that are explained in a document that is accessible on the Virtual Campus of the subject.

To pass this module, it will be necessary to pass each section with a score equal to or greater than 5. Students who do not pass one or both of the module's assessments can retrieve them, on the scheduled date at the end of the semester, by performing an associated written test to the sessions that did not exceed previously.

On the other hand, and as in the analytical module, a maximum of 20% will be penalized with respect to 100% of the final mark of the molecular module. Untruthful attitudes of the student in a laboratory, such as impropriety, non-compliance with the regulations of security or biosecurity, the non-work of autonomous work (outside the sessions) indicated by the teaching staff.

The final grade of the subject will be calculated as the weighted average of the marks reached in each one of the modules that make up this subject, being a necessary condition to pass each one of the modules with a note greater than or equal to 5.

In order to acquire the specific competences of the subject, attendance to the practical classes is mandatory. In the case that a student for a justified and unpredictable cause does not attend to a session/s, he must notify the teacher responsible for the subject and submit the corresponding proof as soon as possible. Health problems are justified (the corresponding medical justification must be attached) or serious personal problems (death of a second-degree relative, accident, an official sport competition, etc.) as is considered in the rules of the Faculty. Since attendance to the programmed activities in this subject is mandatory, in order to be able to pass it, a global attendance of at least 80% of the scheduled sessions is required and the minimum established score is required.

The student will obtain the "Non-Valuable" qualification when he/she has attended less than 80% of the programmed sessions. Students who do not obtain the minimum qualification required to be able to pass each one of the modules of the Integrated Laboratory V, will not approve the subject. In this case, the maximum final grade of the subject will be 4. From the second course, the repeating students may only be evaluated the concrete modules that were not passed in previous courses. In the case of passing the modules in this new course, the final mark of the subject will be the weighted average of the mark of the module/s passed in this academic course with the mark/s of the modules passed in previous courses. In the case of not approving the pending modules, the maximum final grade of the subject will be 4.

### **Evaluation activities**

Title	Weighting	Hours	ECTS	Learning outcomes
Laboratory work	17,5%	4	0.16	3, 14, 12, 11

Oral tests	5%	0.5	0.02	3, 6, 4, 9, 14, 10, 12, 11, 20, 22, 19
Written reports	37,5%	6.5	0.26	3, 6, 1, 7, 8, 5, 2, 4, 9, 15, 10, 12, 11, 18, 20, 16, 13, 17, 22, 23, 24, 25, 21, 19
Written tests	40%	1.5	0.06	6, 1, 7, 8, 5, 2, 4, 9, 15, 10, 18, 20, 16, 13, 17, 22, 23, 24, 25, 21, 19

## Bibliography

The students will have a Guide of the subject where the objectives of each session will be detailed together with the protocols that will be used. The literature associated with each of the different sessions will also be recorded in the Guide.