

**Integrated Laboratory Class 3**

Code: 100926  
ECTS Credits: 3

Degree	Type	Year	Semester
2500253 Biotechnology	OB	2	1

**Contact**

Name: Antonio Javier Moral Vico  
Email: AntonioJavier.Moral@uab.cat

**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

**Teachers**

Octavi Martí Sistac  
Jaume Coll Guerrero  
Esther Julián Gómez

**Prerequisites**

The student must be attending simultaneously or must have taken the theory subjects corresponding to the contents of the laboratory practices.

The student must have passed the safety and biosecurity test in the laboratories. The tests are answered in the corresponding space of the Virtual Campus and the information that must be consulted is in the space of communication of the Degree in Biotechnology. The student must be aware of the regulations of operation and security of the laboratories of the faculty of biosciences and accept that they will be fulfilled. To do so, he/she must deliver signed the certifying document/s to the teacher responsible for each module on the first day of practice before beginning.

**Objectives and Contextualisation**

The Integrated Laboratory 3 is the third subject of a group of 6 that are distributed over the 6 semesters corresponding to the first three years of the Degree in Biotechnology.

The training objectives of these subjects focus on the acquisition of competences within the framework of the practical training of the student.

The contents are organized in a growing order of complexity and associated to the needs and progress of the theoretical contents of the Degree.

The Integrated Laboratory 3 has as its training objectives the acquisition of practical skills in 4 specific contents:

- Transport phenomena

- Microbiology
- Animal Physiology
- Probability and Statistics

The knowledge of probability and statistics from an applied point of view are key to being able to organize and interpret experimental data in the different areas of the Degree.

The rest of the practices in the laboratory focuses on the learning of basic specific techniques for each field and on the characteristics of the work in the laboratory.

## Skills

- Apply general laboratory security and operational standards and specific regulations for the manipulation of different biological systems.
- Apply the principal techniques for the use of biological systems: recombinant DNA and cloning, cell cultures, manipulation of viruses, bacteria and animal and plant cells, immunological techniques, microscopy techniques, recombinant proteins and methods of separation and characterisation of biomolecules.
- Describe the principles behind the design and functioning of bioreactors and calculate, interpret and rationalise the main parameters in transport phenomena and the matter and energy balances in bioindustrial processes.
- Design continuation experiments for problem solving.
- Interpret experimental results and identify consistent and inconsistent elements.
- Lead and manage teams, and develop capacities for organisation and planning
- Learn new knowledge and techniques autonomously.
- Make decisions.
- Search for, obtain and interpret information from the principal databases on biology, bibliography and patents and use basic bioinformatic tools.
- Think in an integrated manner and approach problems from different perspectives.
- Use ICT for communication, information searching, data processing and calculations.
- Use analytical methodologies for assaying the biological activity of cellular components, especially enzymes, both in vitro and in vivo.
- Work individually and in teams

## Learning outcomes

1. Apply the different waste disposal processes correctly.
2. Apply the general safety rules in place in a biotechnology laboratory.
3. Apply the principles of sterility to processes of manipulation and counting of microorganisms.
4. Characterise the physiology of the different organs and the different metabolic states of an organism .
5. Design continuation experiments for problem solving.
6. Extract complementary information from databases to support the analysis of results and the writing of reports on experiments.
7. Interpret experimental results and identify consistent and inconsistent elements.
8. Lead and manage teams, and develop capacities for organisation and planning
9. Learn new knowledge and techniques autonomously.
10. Make decisions.
11. Obtain significant experimental data to calculate transport phenomena and balances of matter and energy.
12. Think in an integrated manner and approach problems from different perspectives.
13. Use ICT for communication, information searching, data processing and calculations.
14. Use the appropriate methodology for studying the different types of biological samples.
15. Use the basic techniques for preparing and observing samples with an optical microscope and an electron microscope.

16. Use the techniques for cultivating prokaryote and eukaryote cells and for manipulating biological systems.
17. Use the techniques for identifying microorganisms based on their metabolic capacities.
18. Work individually and in teams

## **Content**

The subject is structured in 4 types of contents.

### Probability and Statistics

Contents: They are organized in 4 sessions of 2:30h (from 10:30 to 13, the 4 first ones) and one of 3 hours (from 10 to 13, the last) that are held in the **computer room**.

In the successive practical sessions, data analysis will be carried out, progressively developing the following methods:

- 1. Descriptive statistics of a variable.**
- 2. Descriptive statistics of two variables.**
- 3. Calculation of probabilities and simulation.**
- 4. Hypothesis tests.**
- 5. Analysis of variance and regression.**

### Transport phenomena

Contents: They are organized into 5 sessions of 3 h (10 a.m. to 1 p.m.) that are held in **laboratory C**.

#### **1. Experimental determination of viscosities and densities.**

Use of densimeters and viscometers. Determination of the density and viscosity of different aqueous solutions. Experimental observation of the dissolution and mixing heat.

#### **2. Experimental determination of gas diffusivities.**

Evaluation of the molecular diffusion of acetone in air. Comparison with theoretical values.

### Microbiology

Contents: They are organized in 4 sessions of 3 h (from 9 to 12h) that are done in **laboratory A**.

#### **1. Basic material and equipment for the observation, manipulation, isolation, characterization and identification of Microorganisms**

#### **2. Techniques of sterilization and preparation of culture media.**

Study of sterilization techniques. Study of the composition and preparation of culture media. Preparation of material.

Sterilization with autoclave, stove and filtration. Sterility control. Control of aseptic technique.

#### **3. Application of basic microbiology techniques for the observation of microorganisms.**

Sinks and motility. Observation of microorganisms in vivo with clear field microscopy. Differentiation of large groups of microorganisms. Staining techniques of prokaryotes: simple and differential stains.

#### **4. Application of microorganism counting methods.**

Calculation of viable and total cells. Design of dilution banks and sowing with the surface-spread method. Determination of the number of living and dead cells.

#### **5. Application of the basic microbiology techniques for the isolation and identification of microorganisms.**

Rapid methods for isolating microorganisms. Design of enrichment and selection methods. Obtaining pure cultures. Obtaining confluent cultures for sowing en masse and with surface-spread method. Streaking technique. Biochemical tests and fast methods for the identification of microorganisms. Titration of a bacteriophage suspension.

#### **6. Ubiquity and microbial diversity.**

Detecting the presence of microorganisms in all types of environments and observing their capacity for propagation and their high diversity.

### Animal Physiology

Contents: they are organized in 4 sessions of 3 hours that are done in the **laboratory (1 and 2) or computer room (3 and 4)**.

#### **1. Cardiovascular and respiratory adaptation to physical exercise. Influence of sex and hydrostatic pressure.**

Determination of heart rate, systolic and diastolic blood pressure, and saturation of blood oxygen in various conditions before and after exercise. Empirical verification of the effect of hydrostatic pressure on blood pressure.

#### **2. Study of the human electrocardiogram (ECG). Cardiac respiratory physiological arrhythmia (ACRF).**

Acquisition of the ECG and identification of the different waves that comprise it. ECG and ACRF.

#### **3. Identification of structures and gene expression in the central nervous system: virtual brain stereotactic brain atlas.**

Physiological neuroanatomy study of the brain of the mouse to identify some of the main structures that it contains, as well as the degree of gene expression of genes of interest. An interactive 3D steroidal brain mouse atlas will be used, with online access to gene expression databases.

#### **4. Statistical analysis of the data obtained for the whole group of practices.**

Preliminary inspection of the data obtained in sessions 1 and 2, and subsequent statistical analysis of the results obtained for the entire group of practices. Assessment of the possible statistically significant differences in the results.

## **Methodology**

The attendance to the lessons of this subject is mandatory since they imply an acquisition of competitions based on the practical work.

In order to be able to attend the experimental practices, the student must justify having passed the biosafety and security tests that he will find in the Virtual Campus and he/she will have to know and accept the rules of operation of the laboratories of the Faculty of Biosciences. Therefore, the signed document/s will be delivered to the corresponding coordinator of each module on the first day of the practices.

There are 3 practice groups programmed for the Probability and Statistics module and 4 groups for the rest. The distribution of the groups can be consulted in the virtual Campus in the communication area of the Degree in Biotechnology.

## **Probability and Statistics**

Classes in the computer rooms that include the delivery of the statements of the practices, the presentation of the teacher and the realization of the practice.

A document with the program of the lessons will be published in advance to the Virtual Campus. At the end of each practical session, students will have to answer a questionnaire that will be used to evaluate them.

### **Transport phenomena, Microbiology and Animal Physiology**

Practical classes of laboratory and data analysis. The students perform the experimental work in groups of 2 and under the supervision of the professor/s responsible for each session.

The practice protocols and, if applicable, the questionnaires for response, will be available on the Virtual Campus of the subject.

Before beginning a practical session the student must have read the protocol and know therefore the objectives of the practice, the foundations and the procedures that must be carried out. If so, you must also know the specific safety and waste treatment measures. To attend module of microbiology, it is necessary for the student to justify having passed the safety and biosecurity tests that will be found in the Virtual Campus. In addition, they must comply with the regulations to work in a Microbiology laboratory that they will find indicated in the corresponding protocol.

In the practical sessions you must bring:

- Protocol and, if applicable, the questionnaire.
- A notebook to collect the information of the experimental work.
- Lab coat.
- Safety glasses.
- Permanent marker.

### **Activities**

Title	Hours	ECTS	Learning outcomes
<b>Type: Directed</b>			
Animal Physiology	12	0.48	9, 13, 4, 5, 7, 12
Microbiology	12	0.48	9, 1, 3, 13, 2, 5, 7, 12, 15, 17, 16
Probability and statistics	13	0.52	13, 7, 11
Transport Phenomena	15	0.6	9, 1, 13, 2, 5, 7, 11, 12, 18
<b>Type: Autonomous</b>			
Report writing and questionnaires resolution	15	0.6	9, 13, 5, 6, 7, 8, 12, 18
Studying	8	0.32	9, 13, 5, 6, 7, 12, 18

### **Evaluation**

#### **Important notes to take into account**

- Attendance to practical sessions (or field trips) is mandatory. Students missing more than 20% of programmed sessions will be graded as "No Avaluable"

- To be eligible for the retake process, the student should have been previously evaluated in a set of activities equaling at least two thirds of the final score of the course or module. Thus, the student will be graded as "No Avaluable" if the weighthin of all conducted evaluation activities is less than 67% of the final score.

## **Evaluation system of the different parts of the subject**

### **Probability and Statistics**

The evaluation system consists of a single component:

1 Continuous assessment of the work: Resolution of the questionnaires filled by the students at the end of each practical session.

### **Transport phenomena**

The evaluation system is organized in two parts, each one of which will be assigned a specific weight in the final grade:

1 Continuous assessment of group work: the practical ability of each group of students will be evaluated daily (self-evaluation, consistent and inconsistent elements analysis, data treatment during the practical sessions). Skills: E8, T1, T2, T5, T9, T11, T12

2 Evaluation of the work reflected in a written report of the practical results of each laboratory (practices of diffusivity and viscosity/density), which will be given to the teaching staff at the end of the practices. Skills: E8, T1, T2, T5, T9, T11, T12.

These tests will have the following weights: Work in the laboratory and attitude 2 points; Written report: Viscosity and density 4 points, diffusivity 4 points, respectively on a total of 10.

### **Microbiology**

The evaluation system is organized in two parts:

1 Continuous evaluation of group work: the practical ability of each group of students will be evaluated daily, which will consist of the delivery of different practical results to the teaching staff obtained each laboratory session. Skills: E3, E16, T1, T2, T5, T11, T12.

2 Individual assessment of the contents (written test module): a written test will be performed on the last day of the laboratory practical classes, which will consist of 20 test questions about the work done in the laboratory. Skills: E3, T1, T2, T5, T11, T12

These tests will have a weight of 4 and 6 points, over 10, respectively.

### **Animal Physiology**

The assessment will consist of two parts:

1 Evaluation of group work: The group must submit a report on one of the practices carried out, in a format that is comparable to that of a scientific paper, in accordance with the guide that will be provided by the responsible professor. Skills: E3, E16, T1, T2, T5, T11, T12

2 Individual assessment: Each student must submit the reduced version of a report on one of the practices carried out, according to the teacher's instructions. Skills: E3, T1, T2, T5, T11, T12

These tests will have a weight of 6 and 4 points, over 10, respectively.

### **Final Evaluation**

The final evaluation of the subject will be obtained from the weighted average of the evaluation of the four modules that the subject consists of.

To pass the subject, at least 80% of the programmed sessions must be at least equal to or greater than 5 and obtain a minimum grade of 4 in each group of contents. Students who do not achieve the minimum qualification of 4 in one or more of the groups of contents will receive a maximum final grade of the subject of 4 points.

#### Other aspects:

- A student will obtain the **non-evaluable** qualification when he has attended less than 50% of the programmed sessions of a module.
- The **repeating students** will only have to perform and be evaluated of the contents of the modules that had not been passed in the first enrollment (<4). For the contents of the modules passed, the note will be kept for a maximum period of three additional tuition placements.
- **Plagiarism:** Notwithstanding other disciplinary measures that are deemed appropriate, and in accordance with the current academic regulations, the irregularities committed by the student who can lead to a variation of the qualification of a Act of evaluation. Therefore, copying or copying a test, exercise or practice or any other evaluation activity will involve suspending it with a zero, and if it is necessary to pass the subject, the entire subject will be failed. Qualified assessment activities will not be recovered in this way and by this procedure, and therefore the subject will be failed directly without opportunity to recover it in the same academic year

#### Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Animal physiology: Group work evaluation	25%	0	0	9, 13, 4, 5, 6, 7, 8, 12, 10, 18
Animal physiology: Individual evaluation	15%	0	0	9, 13, 4, 6, 7, 12, 10, 18
Microbiology: Continuous evaluation	10%	0	0	9, 1, 3, 13, 2, 5, 6, 7, 8, 12, 10, 14, 15, 17, 16
Microbiology: Individual written exam	10%	0	0	9, 3, 13, 5, 7, 12, 15, 17, 16
Probability and statistics: continuous evaluation	15%	0	0	7
Transport phenomena: Written report in groups	20%	0	0	9, 13, 5, 7, 11, 12, 18
Transport phenomena: Continuous evaluation	5%	0	0	9, 13, 5, 7, 8, 11, 12, 10, 18

#### Bibliography

Bibliography and web links are indicated in the practice protocols or, where appropriate, in the Teaching Guide of the corresponding theory subject.