Universitat Autònoma de Barcelona

2020/2021

Integrated Laboratory Class 3

Code: 100926
ECTS Credits: 3

Degree	Type	Year	Semester
2500253 Biotechnology	OB	2	1

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

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

Teachers

Josep Maria Burgués Badía
Antonio Javier Moral Vico
Ugutz Unzueta Elorza

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

- Molecular Biology and Genetics

- 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.

Competences

- 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.
- Work individually and in teams

Learning Outcomes

1. Apply the different waste disposal processes correctly.
2. Apply the fundamental techniques used in the analysis, purification, and characterisation of biomolecules.
3. Apply the general safety rules in place in a a biotechnology laboratory.
4. Apply the principles of sterility to processes of manipulation and counting of microorganisms.
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 handling, separating, detecting and analysing proteins and nucleic acids.
16. Use the basic techniques for manipulating, identifying, observing through a microscope and counting viruses.

17. Use the basic techniques for preparing and observing samples with an optical microscope and an electron microscope.
18. Use the techniques for cultivating prokaryote and eukaryote cells and for manipulating biological systems.
19. Use the techniques for identifying microorganisms based on their metabolic capacities.
20. Work individually and in teams

Content

The subject is structured in 4 modules.

Probability and Statistics

Contents: They are organized in different sessions 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 one or more variables.

2. Calculation of probabilities and simulation.

3. Hypothesis tests.

Some material for establishing the analysis of variance and regression will be provided.

Transport phenomena

Contents: They are organized in several sessions that are held in the 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 several sessions that are held in the Biotecnology laboratory A. In these sessions we will work on 6 practices that will partially overlap in time and that will be complemented with additional material provided through the virtual campus.

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 microbians. 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.

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.

Molecular Biology and Genetics

Contents: they are organized in several sessions that are held in the Biotecnology laboratory A. In these sessions we will work in 3 practices that will partially overlap in time.

1. Basic concepts of DNA cloning
The aim of the practice is to present in an integrated way some of the basic stages and methodologies underlying DNA cloning, such as transformation of competent *E. coli* cells, transformant selection, screening for phenotypic characteristics by replication in specific media plates, and obtaining, digestion with restriction enzymes, and plasmid DNA analysis.

2. Spectrophotometric DNA analysis
The UV absorption spectrum will be obtained and the concentration and purity of the analyzed DNA sample will be determined. The hyperchromic effect due to DNA denaturation will be observed.

3. Superhelicity of DNA
The action of topoisomerase I on pDNA topology will be observed. The assay in the presence of the camptothecin inhibitor will reveal the mechanism of the enzymatic activity.

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.

The results of the practice itself must be delivered and this is assessed. At the beginning of the course, an exact format for the realization of the practices will be published in the VC.

Transport phenomena, Microbiology and Animal Physiology

Practical classes of laboratory and data analysis. The students perform the experimental work 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 theobjectives 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.

- Mask

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Microbiology	12	0.48	9, 1, 4, 13, 3, 5, 7, 12, 16, 17, 19, 18
Molecular Biology and Genetics	12	0.48	9, 1, 4, 3, 5, 7, 12, 10, 20, 14, 19, 18
Probability and statistics	13	0.52	13, 7, 11
Transport Phenomena	15	0.6	9, 1, 13, 3, 5, 7, 11, 12, 20
Type: Autonomous			
Report writing and questionnaires resolution	15	0.6	9, 13, 5, 6, 7, 8, 12, 20
Studying	8	0.32	9, 13, 5, 6, 7, 12, 20

Assessment

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 (see time table), which will consist of 20 test questions about the work done in the laboratory and about the additional material on the virtual campus . Skills: E3, T1, T2, T5, T11, T12

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

Biology and Molecular Genetics

This module will be evaluated by means of an individual exam in which questions and exercises related to the practices carried out will have to be solved. The exam will take place after the practice sessions of the four groups (see calendar).

The supervision of the work and of the results achieved in the laboratory, that will occur during the realization of the practices (continuous assesment), will provide up to 10% of the overall mark of the module.

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 theprogrammed sessions must be at least equal to or greater than 5 and obtain a minimum grade of 4 in each group of contents. Students whodo 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, andin 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

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Microbiology: Continous evaluation	10%	0	0	9, 1, 4, 13, 3, 5, 6, 7, 8, 12, 10, 14, 16, 17, 19, 18
Microbiology: Individual written exam	10%	0	0	9, 4, 13, 5, 7, 12, 17, 19, 18
Molecular Biology and Genetics: Continuous assessment	2,5%	0	0	9, 1, 4, 3, 2, 14, 15, 18
Molecular Biology and Genetics: Examination	22,5%	0	0	9, 5, 7, 12, 10
Probability and statistics: continous evaluation	15%	0	0	7
Transport phenomena: Written report in groups	20%	0	0	9, 13, 5, 7, 11, 12, 20
Transport phenomena:Continous evaluation	5%	0	0	9, 13, 5, 7, 8, 11, 12, 10, 20

Bibliography

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