# Integrated Laboratory 1

Code: 100928
ECTS Credits: 3

2025/2026

| Degree | Type | Year |
|---|---|---|
| Biotechnology | OB | 1 |

## 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 recommended that students are simultaneously taking or have already taken the theory courses corresponding to the contents of the laboratory practices of Integrated Laboratory 1.

It is necessary for the student to have passed the biosafety test for teaching laboratories available in *Campus Virtual* (Moodle class of the Faculty of Biosciences) and to know and to accept the rules of operation of the laboratories of the Faculty of Biosciences.

## Objectives and Contextualisation

The Integrated Laboratory 1 is the first 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 learning objectives of these subjects focus on the acquisition of skills related to the practical training of the students.

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

The learning objectives of Integrated Laboratory 1 focus on the acquisition of practical skills in 4 specific content modules:

- Informatics
- Cell Biology

- Instrumental Techniques
- Biochemistry

The knowledge of Informatics from an applied point of view is key for the use of specific computer applications in the different areas of the Degree, especially in those of Mathematics and Engineering. The rest of laboratory practices focus on the learning of basic techniques specific to each field and on the characteristics of the laboratory work.

## Learning Outcomes

1. CM22 (Competence) Prioritise the instrumentation necessary for the different techniques for the separation and characterisation of biomolecules.
2. CM23 (Competence) Propose strategies for the purification of biomolecules from complex mixtures.
3. CM24 (Competence) Review the general safety standards of a biotechnology laboratory.
4. KM23 (Knowledge) Recognise the key microscopic characteristics that distinguish prokaryotic cells from eukaryotic cells, and animal cells from plant cells.
5. KM24 (Knowledge) Explain the theoretical foundation and appropriate techniques for the structural and functional characterization of proteins and nucleic acids.
6. SM20 (Skill) Use the basic techniques of manipulation, separation, detection and analysis of proteins and nucleic acids.
7. SM21 (Skill) Use prokaryotic and eukaryotic cell culture techniques and techniques for the manipulation of biological systems.
8. SM22 (Skill) Use analytical methodologies for the assay of biological activity of cellular components.

## Content

The course includes 4 types of contents or modules.

Informatics

The practices are organized in 5 sessions of 2 h that take place in the computer rooms.

Practice 1 (2h). Introduction to Bash: First instructions: ls, cd, pwd, ... File manipulation: directory system/folders, redirects, visualization and file sorting, ...

Practice 2 (2h). File manipulation: sort, grep and AWK.

Practice 3 (2h). Introduction to spreadsheets: LibreOffice Calc (I).

Practice 4 (2h). Introduction to spreadsheets: LibreOffice Calc (II).

Practice 5 (2h). Practical application.

Cell Biology

The practices are organized in 6 sessions of 2 h that take place in the laboratory.

Practice 1 (2h). Introduction to the optical microscope and observation of plant cells. Description of the optical microscope elements and instructions for using the microscope. Obtaining temporary preparations from different plant tissue samples (peppers, *Elodea*) and observing the morphology of plant cells and their main components: cell wall, nucleus, chloroplasts, chromoplasts, plasmodesmata.

Practice 2 (2h). Observation of animal cells under the optical microscope. Observation of the morphology of different types of animal cells: oral mucosa cells, fibroblasts and spermatozoa.

Practice 3 (2h). Introduction to electron microscopy. Fundamentals of electron microscopy. Recognition and measurement of different structures and cell organelles in SEM and TEM micrographs.

Practice 4 (2h). Osmosis and simple diffusion. Study of osmosis in *Elodea* leaf cells exposed to different concentrations of NaCl. Study of simple diffusion of alcohols across the membrane of *Elodea* leaf cells.

Practice 5 (2h). The mitotic cell division. Preparation of slides of plant tissues to observe and recognize the different mitotic phasesand estimate their duration.

Practice 6 (2h). The meiotic cell division. Observation of the different phases of the meiotic cycle of spermatogenesis in insects.

Instrumental Techniques

*Basic techniques of laboratory work. Application of spectrometry.*

Practice 1 (4h). Preparation of a pH buffer system. Determination of glucose concentration using a colorimetric method. Analysis of an absorption spectrum.

*Use of the basic techniques of separation, detection and analysis of proteins and nucleic acids.*

Practice 2 (4h). Determination of protein concentration using a colorimetric method (Bradford). Separation of proteins by SDS electrophoresis (Part 1). Amplification of a gene by PCR, effect of $Mg^{2+}$ concentration (Part 1).

Practice 3 (4h). Determination of the Mr of some proteins by SDS electrophoresis (example: milk proteins). Separation of DNA fragments by agarose electrophoresis (identification of amplified PCR fragments obtained in practice 2).

Biochemistry

*Application of the basic techniques for the analysis, purification and characterization of biomolecules.*

Practice 1 (4h). Gel filtration chromatography: separation of hemoglobin from vitamin B12 and blue dextran. Process of expression and purification of a heterologous protein: GFP (green fluorescence protein).

Practice 2 (4h). Continuation of the process of GFP purification. Hydrophobic chromatography: partial purification of GFP from a bacterial extract.

Practice 3 (4h). Identification of lipids by thin layer chromatography. Determination of the pKa of p-nitrophenol and its usefulness to follow the enzymatic activity of phosphatase.

*Basic techniques of analysis of enzymatic activity. Study of the activity of acid phosphatase.*

Practice 4 (4h). Application of spectrometry to theanalysis of enzymatic activity. Determination of the optimal pH for the activity of an enzyme. Determination of the time in which the linearity of the reaction is maintained. Obtention of initial rate data to determine the kinetic parameters KM and Vm of the reaction. Analysis of the effect of an inhibitor on enzymatic activity.

Practice 5 (2h). Use of computer tools to determine the value of pKa and the kinetic parameters. Use of the GRAFIT program. Determination of pKa of p-nitrophenol from the data obtained in practice 3. Determination of kinetic parameters, KM and Vm, from the data obtained in practice 4. Determination of the type of inhibition and the corresponding inhibition constants from the data obtained in practice 4.

## Activities and Methodology

| Title | Hours | ECTS | Learning Outcomes |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Type: Directed | | | |
| Practical classes in laboratories and computer rooms | 52 | 2.08 | CM22, CM23, CM24, KM23, KM24, SM20, SM21, SM22, CM22 |
| Type: Supervised | | | |
| Tutorials | 3 | 0.12 | |
| Type: Autonomous | | | |
| Resolution of questionnaries | 12 | 0.48 | CM22, CM23, CM24, KM23, KM24, SM20, SM21, SM22, CM22 |
| Study | 8 | 0.32 | CM22, CM23, KM23, KM24, SM20, SM21, SM22, CM22 |

Classes will take place in the computer rooms and teaching laboratories, in small groups of students.

Class attendance is mandatory, since it implies the acquisition of skills based on practical work. Absences must be properly justified to the coordinator of the corresponding module (indicated in the document "*Equip docent*" available in *Campus Virtual*). At the discretion of the coordinator, and only if possible according to the calendar and the organization of the laboratory sessions, the student will be offered an alternative date to take the practical session missed. This possibility will not be offered in case of unjustified absences.

Students must attend the classes with their group. In case of specific incompatibilities, reciprocal changes will be accepted between students from different groups, although it will be necessary to inform the coordinator of the corresponding module in advance of the change.

Informatics

Classes in the computer rooms that include the delivery of the practice protocol, the presentation by the teacher and the realization of the practice. All the materials will be available in *Campus Virtual*.

Cell Biology, Instrumental Techniques and Biochemistry

Practical classes of laboratory and data analysis. The students will perform the experimental work in pairs and under the supervision of the teacher.

Practical protocols and, if applicable, the questionnaires for response, will be available in *Campus Virtual*.

Before each practice session students must have read the protocol and know the objectives of the practice, the fundamentals, and the procedures that will be carried out. If applicable, they should also be familiar with the specific safety and waste treatment measures.

In the practical sessions, students must bring:

- The protocoland, if applicable, the questionnaire.

- A notebook to collect the information from the experimental work.

- Laboratory coat.

- Safety glasses.

- Permanent marker.

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 |
|---|---|---|---|---|
| Biochemistry: Answer of questionnaires | 35% | 0 | 0 | CM22, CM23, CM24, KM24, SM20, SM21, SM22 |
| Cell Biology: Answer of questionnaires | 23% | 0 | 0 | KM23, SM21, SM22 |
| Informatics: Answer of questionnaires | 19% | 0 | 0 | KM24, SM22 |
| Instrumental Techniques: Answer of questionnaires | 23% | 0 | 0 | CM22, CM23, CM24, KM24, SM20, SM21, SM22 |
| Monitoring of the laboratory work | 0% | 0 | 0 | |

Informatics

The evaluation will be done through the delivery of two questionnaires, at the end of each of the two blocks of the Informatics module.

These questionnaries, which can be worked on in part in the classroom, will assess the knowledge and computer techniques acquired, as well as the understanding of the processes involved.

Students with two or more unjustified absences will receive a maximum mark of 3,5 points and will not be eligible for any type of reassessment, which means that they will not be able to pass the subject of *Laboratory Integrat 1*.

Cell Biology

The practices will be evaluated through multiple choice questionnaires that students will have to answer at the end of each of the practical sessions. The final mark of this module will be the average mark of all of questionnaires.

Students with two or more unjustified absences will receive a maximum mark of 3,5 points and will not be eligible for any type of reassessment, which means that they will not able to pass the subject of *Laboratori Integrat* 1.

Instrumental Techniques and Biochemistry

The practices will be evaluated taking into account:

1) The resolution of the questionnaires, which will evaluate:

- The understanding of the fundamentals of the experimental methods.
- The ability to process and analyze experimental data.
- The ability to interpret experimental results.
- The use of the computer application for kinetic data analysis.

2) The monitoring of the experimental work in the laboratory, which will evaluate:

- The preliminary preparatory work, especially in those practices that require previous calculations.
- The application of the general rules of safety and operation of a laboratory.

- The application of waste disposal processes.
- The ability to work as a team.

Students with two or more unjustified absences will receive a maximum mark of 3,5 points and will not be eligible for any type of reassessment, which means that they will not able to pass the subject of *Laboratori Integrat* 1.

Use of AI

In this subject, the use of Artificial Intelligence (AI) technologies is not permitted at any stage. Any work that includes fragments generated with AI will be considered an act of academic dishonesty and may result in a partial or total penalty in the grade for the activity, or more severe sanctions in serious cases.

Single assessment

Students taking the single assessment must attend the laboratory practices in person, on the dates assigned to the group to which they belong. They will also need to answer the multiple choice questionnaires at the end of each Cell Biology practice session.

The only difference with respect to the continuous evaluation is that there will be a single delivery date for the questionnaires corresponding to the modules of Informatics, Instrumental Techniques, and Biochemistry, which will be the one set for the last delivery of the subject's questionnaires in the continuous evaluation. Nonetheless, for those practical modules that are carried out in groups of two students and that require the preparation and delivery of a joint questionnaire, if one of the members of the group is not following the single assessment, the joint questionnaire will have to be delivered on the same date set for continuous evaluation.

Final grading

The final grade of the subject will be the weighted average of the marks of the different modules,as follows: 19% Informatics, 23% Cell Biology, 23% Instrumental Techniques and 35% Biochemistry. To pass the subject, the final grade must be of at least 5 points.

The weighted average will only be applied when the individual mark of each of the four modules is of at least 4 points. Students with marks lower than 4 in one or more of the modules will not be able to pass the subject and will receive a maximum final grade of 4 points.

Students will receive the "*No Avaluable*" qualification when attending less than 20% of the programmed sessions of the subject.

Repeating students

Repeating students will have to retake the practices and the corresponding evaluation only of the module or modules that they failed (<4 points) in the first enrollment. For the modules already passed, the marks will be kept for a maximum period of three additional enrollments.

## Bibliography

Informatics

Introduction to Gnu/Linux:


Josep Maria Mondelo, Guia de supervivència informàtica, UAB, 2003.

Lluís Alsedà, Recordatori de comandes bàsiques de Linux, UAB, 2004.

Albert Ruiz, Manipulació de fitxers, UAB, 2008.

Albert Ruiz, Introducció a l'awk, UAB, 2008.

LibreOffice manuals:

Official web page (https://documentation.libreoffice.org/)

"Getting Started Guide" ( https://documentation.libreoffice.org/assets/Uploads/Documentation/en/GS5.2/GS52-GettingStartedLO.pdf )

Cell Biology

Alberts B, Heald R, Johnson A, Morgan D, Raff M, Roberts K, Walter P, Wilson J. Molecular Biology of the Cell. 7th Edition. W. W. Norton & Company. 2022. ISBN: 978-0-393-88484-5.

Lodish H, Berk A, Kaiser CA, Krieger M, Bretscher A, Ploegh H, Martin KC, Yaffe M, Amon A. Molecular Cell Biology. 9th Edition. Macmillan Learning. 2021. ISBN: 9781319365493.

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Instrumental Techniques and Biochemistry

Lehninger Principles of Biochemistry (2017). Nelson, D.L. and Cox, M.M. 7ª ed. Freeman, New York.

Biochemistry Laboratory: Modern Theory and Techniques, 2nd Edition, 2012. Rodney Boyer. Ed. Pearson. ISBN: 9780136043027.

Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology, 8th Edition, 2018. Andreas Hofmann and Samuel Clokie. Ed. Cambridge University Press. ISBN: 9781316614761.

Técnicas instrumentales de análisis en Bioquímica. Juan Manuel García Segura. 1999. Ed. Síntesis. ISBN: 8477384290.

Calculations for Molecular Biology and Biotechnology. Frank Stephenson. 3rd Edition. 2016. Ed. Elsevier. ISBN: 9780128022115.

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Biochemical Calculations: How to Solve Mathematical Problems in General Biochemistry, 2nd Edition, 1976. Irwin Segel. Ed. Wiley. ISBN: 978-0-471-77421-1

Fundamentals of Biochemical Calculations. Second Edition. 2008. Krish Moorthy. Ed. CRC Press. ISBN: 9780429142185

https://bibcercador.uab.cat/permalink/34CSUC_UAB/15r2rl8/cdi_fao_agris_US201300124165

Principles and Techniques of Biochemistry and Molecular Biology. Andreas Hofmann and Samuel Clokie. Cambridge University Press, 8th Edition (2018)

Principios de análisis instrumental. Douglas A. Skoog et al. Cengage Learning Editores S.A. de C.V., Sexta edición revisada (2008)

Técnicas de Bioquímica y Biología Molecular. David Freifelder. Editorial Reverté. (2010). ISBN: 84-291-1819-5

## Software

GraFit

Linux: BASH and LibreOffice Calc

## 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 | 411 | Catalan | first semester | morning-mixed |
| (PLAB) Practical laboratories | 412 | Catalan | first semester | morning-mixed |
| (PLAB) Practical laboratories | 413 | Catalan | first semester | morning-mixed |
| (PLAB) Practical laboratories | 414 | Catalan | first semester | morning-mixed |