

Laboratory I

Code: 101907
ECTS Credits: 6

Degree	Type	Year	Semester
2501230 Biomedical Sciences	OB	1	A

Contact

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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

Prerequisites

Being a course in the first semester of the first course of the degree, obviously it will not be necessary to have previously attained any knowledge or skills given by any of the courses of the degree.

However, the course cannot "start from scratch" since the learning of Biology and Chemistry is part of the studies in secondary school. Basic knowledge of Human Biology and Organic and Inorganic Chemistry will ease the achievement of the competences of the course. Even though the first chapters of the program are devoted to review these basic concepts, starting the course having revised them will prove useful.

Objectives and Contextualisation

The subject "Laboratori I" in the 1st course of the Degree develops the foundations of the more basic techniques in biomedical research. The subject is formed by eight independent areas or modules, being the ECTS allocated as follows:

- 1.- Bioquímica I (1 ECTS).
- 2.- Bioquímica II (1 ECTS)
- 3.- Genètica (1 ECTS).
- 4.- Biologia cel·lular (1 ECTS).
- 5.- Histologia (0.5 ECTS).
- 6.- Fisiologia (0.5 ECTS).
- 7.- Microbiologia i virologia (0.5 ECTS).
- 8.- Bibliografia biomèdica (0.5 ECTS).

This subject is followed in the 2nd course by the subject "Laboratori II", also allowing a better understanding of other subjects with a high experimental content, such as Pharmacology o Molecular Biology of the Cell.

Subject aims:

- 1) To identify the main basic experimental techniques used in every one of the aforementioned modules.
- 2) To apply the acquired knowledge in the planning and implementation of research projects, as well as in the development and innovation in a Clinical or Biomedical laboratory. To identify and to apply the correct study methodologies in the development of research projects. To plan and implement experiments and procedures of analyses in the biomedical field.
- 3) To demonstrate that the bases and the elements used in the development and validation of techniques of diagnoses and therapeutics are known. To identify and critically evaluate methodologies for the experimental study of diseases.
- 4) To correctly use the security protocols in the laboratory, as well as the residues management.
- 5) To be competent in the use of the basic information sources used in science: to correctly identify accredited information sources, to learn to correctly cite works and to evaluate the impact of the publication.

Skills

- Apply knowledge acquired to the planning and implementation of research, development and innovation projects in a biomedical research laboratory, a clinical department laboratory or the biomedical industry.
- Contribute to public discussions on cultural matters.
- Develop critical thinking and reasoning and communicate ideas effectively, both in the mother tongue and in other languages.
- Develop independent learning habits and motivation to continue training at postgraduate level.
- Develop independent learning strategies.
- Display knowledge of the bases and elements applicable to the development and validation of diagnostic and therapeutic techniques.
- Display knowledge of the basic life processes on several levels of organisation: molecular, cellular, tissues, organs, individual and populations.
- Generate innovative and competitive proposals for research and professional activities.
- Identify and understand the advances and challenges of research.
- Plan and implement laboratory analysis experiments and procedures belonging to the biomedical field.
- Respect diversity in ideas, people and situations.
- Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.

Learning outcomes

1. Contribute to public discussions on cultural matters.
2. Correctly use protocols for laboratory safety and waste management.
3. Describe the fundamental principles of analytical methodology used in the diagnosis of diseases.
4. Develop critical thinking and reasoning and communicate ideas effectively, both in the mother tongue and in other languages.
5. Develop independent learning habits and motivation to continue training at postgraduate level.
6. Develop independent learning strategies.
7. Generate innovative and competitive proposals for research and professional activities.
8. Identify and apply suitable functional study methodologies for the development of research projects.
9. Identify and critically evaluate methodologies for the experimental study of diseases.
10. Identify and understand the advances and challenges of research.
11. Identify the different components of the immune system: molecules, cells and organs.
12. Identify the principal experimental techniques in cell and molecular biology, genetics and immunology.
13. Relate the behaviour, structure and function of chromosomes to human pathology.
14. Respect diversity in ideas, people and situations.
15. Understand techniques of amplification, restriction and hybridation of nucleic acids.
16. Understand the diagnostic techniques based on immunological methods.
17. Understand the processes of genetic manipulation.

18. Understand the techniques for obtaining and observing DNA, chromosomes, proteins, cell organelles and cells.
19. Use immunological techniques.
20. Use optical and electronic microscopy to identify cell types, their components and their principal characteristics.
21. Use procedures for analysing the structure, properties and function of cellular molecules and organelles.
22. Use procedures of organic synthesis, purification, identification and quantification of biologically active compounds, biomolecules and cell organelles.
23. Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.

Content

"Laboratori I" consists in Laboratory or classroom work applicable at any biomedical research issue which a future Graduate in Biomedical Sciences can find:

Biochemistry Module I (1 ECTS):

1. Determination of glucose concentration by a colorimetric methods.
2. Preparation of buffer solutions.
3. Gel-filtration chromatography.
4. Process of Expression and Purification of a heterologous protein.
5. Determination of protein concentration by a colorimetric methods.
6. Separation of proteins by SDS-electrophoresis.

Cell Biology Module (1 ECTS):

1. Introduction to handling with the conventional optical microscope observations.
2. Introduction to electron microscope.
3. Transport through membranes: Diffusion and osmosis.
4. Morphological and functional studies of the cells.
5. Basic cell culture techniques.

Genetics Module (1 ECTS):

1. Observations in human chromosomes.
2. Observations of wing mutations in *D. melanogaster*.
3. Determination of a genetic map.
4. Determination of genetic variability.

Biomedical Bibliography Module (0.5 ECTS):

1. To identify and locate books and magazines.
2. To learn to look for other specific online resources.
3. How to connect to the electronic resources from outside UAB (VPN connection).

4. The net of data bases: PubMed Central PubMed and PubMed Books.
5. Search through Google Scholar. To take advantage of Preferences in Google Scholar and in SCIRUS.
- 6-To interpret a citation: the essential parts and the abbreviated titles.
7. Best Practices: The Argumenta module.
8. RefWorks as a tool of personnel bibliographic information management.

Module Virology and Microbiology (0.5 ECTS):

1. Techniques of sterilization.
2. Preparation of culture media.
3. Methods of microorganism counting.
4. Methods of conservation and isolation of microorganisms.
5. Observation of microorganisms. Staining and motility.
6. Identification of microorganisms.

Histology Module (0.5 ECTS):

Practice 1: To learn histological techniques from animal sources. Microscopic identification of epithelial, conjunctive, adipose, cartilaginous and bone tissue.

Practice 2: Obtaining and staining of blood smears. Microscopic identification of blood elements and of the nervous and muscular origin.

Physiology Module (0.5 ECTS):

Practice 1: Nerve impulses in the peripheral nerves.

To learn instruments and techniques in the study of the conduction of impulses from peripheral nerves.

-Learn the meaning of the functional electrophysiological records in the sensory nerves.

-To observe variations in the speed of nerve conduction with body temperature.

-To check the existence of refractory periods in the production of the nerve impulses.

-To calculate and interpret the basic parameters of the electrophysiological recordings in the peripheral nervous system.

Practice 2: Neuromuscular Function.

-To get tension recordings of contractile skeletal muscle.

-To observe the summation of contractions with repeated stimulation.

To demonstrate from appearing muscle fatigue with repeated contraction.

Biochemistry Module II (1 ECTS):

1. Analysis of serum lipids: thin layer chromatography and enzymatic assay.
2. Determination of kinetic Parameters of an enzymatic reaction.
3. Introduction to Mass Spectrometry and Proteomics.

Methodology

The center of the learning process is the work of the student, structured basically in practical classes. The student learns to work, being the mission of the teacher to help him in this task by providing information or showing the sources where it can be achieved and directing his steps so that the learning process can be carried out effectively. If this is true for any subject, in a fully practical one as "Laboratory I" is not only valid, but the work of the student happens a basic need for the existence of the subject in real time.

At the beginning of each semester the student receives a dossier or script with the practical work that will have to develop in that semester. In general, students have to carry out the experimentation indicated in the script, following the initial instructions provided by the teachers. Once the results are obtained, the results will be shared, discussing both the point of view of the experimental base and the biological context of the results obtained. In this part, or in any other that is considered opportune, it will be possible to carry out small seminars on the technique of interest. The seminars have a double mission. On the one hand the scientific-technical knowledge obtained in the practical classes is worked, to complete their understanding and to deepen in them developing diverse activities, from the typical resolution of problems to the discussion of practical cases. On the other hand, seminars are the natural forum in which to discuss in group the development of practical work, providing the necessary knowledge to bring it forward, or indicating where and how they can be acquired. The mission of the seminars is to promote the capacity for analysis and synthesis, critical reasoning, and problem-solving ability, beyond the simple realization of an experimental protocol.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Laboratory classes	105	4.2	17, 15, 16, 18, 3, 11, 8, 10, 9, 12, 13, 23, 20, 2, 21, 22, 19
Type: Supervised			
Tutorship	4.5	0.18	1, 5, 4, 7, 14, 23
Type: Autonomous			
Assessment	3	0.12	1, 4
Preparation of questionnaires, reports and panels.	22.5	0.9	1, 6, 5, 4, 7, 10, 14, 23
Study	15	0.6	6, 5, 10, 23

Evaluation

The subject Laboratory I is divided into eight Modules: Biomedical Bibliography (BB), Biochemistry I (BQ I), Biochemistry II (BQ II), Cell Biology (BC), Genetics (G), Microbiology and Virology (H) and, finally, Physiology (F). Each of these Modules is evaluated completely independently. The final grade of the subject is obtained with the calculation of the average of all eight Modules, in a weighted way respect the ECTS of each of the Modules, according to the following formula:

$$\text{Note Lab I} = ((\text{BB} \times 0.5) + (\text{BQI}) + (\text{BQII}) + (\text{BC}) + (\text{G}) + (\text{MV} \times 0.5) + (\text{H} \times 0.5) + (\text{F} \times 0.5)) \times 1/6$$

In order to attend the laboratory practice sessions it is necessary for the student to justify having passed the biosafety and safety tests that will be found in the Virtual Campus and to be knowledgeable and accept the operating rules of the laboratories of the UAB and the Faculty of Biosciences.

Continued assessment of this subject has three fundamental objectives:

- 1) To monitor the teaching-learning process, allowing both the student and the teacher to know the degree of achievement of the competencies and correct, if possible, the deviations that occur,
- 2) to encourage the student's continued effort against the often useless, last-minute effort
- And 3) to verify that the student has achieved the competencies determined in the curriculum.

The assessment of the competences of this subject can include different written tests, the laboratory work and the elaboration of different types of works, according to decision of the responsible teachers of each Module. The general assessment system is based mainly on papers or questionnaires to be delivered by teachers. In addition, if a Module considers it appropriate, a section can be included in the assessment on attitudes (timeliness, bringing the required material, responsibility, carrying out all tasks in a timely manner, cleaning, etc.) and skills (manipulation of the laboratory material with correction, realization of the calculation operations in the correct way, etc.) in a percentage that can be of 25% on the total note of the module, maximum.

Since the attendance to the activities programmed in these subjects is obligatory, the absence to some of them has to be justified. To be able to pass the subject requires a global attendance of at least 75% of the sessions scheduled in each Module and obtain the minimum score set for each Module. A student will be considered "Not Evaluable" when attending less than 20% of scheduled sessions.

Students who do not obtain the minimum qualification required to pass each of the Modules will not approve the subject. In this case, the final maximum grade of the subject will be 4. From the second enrollment, the repeating students will only have to evaluate the specific modules that have not been passed. This exemption will be maintained for a period of three additional registrations. There is no possibility of improving notes, except in the case of repeaters.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Assessment of attitude and responsibility.	20%	0	0	6, 7, 14, 23, 2
Reports and questionnaires.	80%	0	0	17, 15, 16, 18, 1, 3, 6, 5, 4, 7, 11, 8, 10, 9, 12, 13, 14, 23, 20, 2, 21, 22, 19

Bibliography

Basic General Bibliography:

- 1) Practical Approach Series (Enzyme assays, Basic cell cultures, Human cytogenetics, Gel electrophoresis, etc.). 2000-2002, Oxford University Press.
- 2) Aula Virtual de l'Autònoma Interactiva: <https://cv2008.uab.cat>