UAB
Universitat Autònoma de Barcelona

Laboratory II

Code: 101906
ECTS Credits: 6

2024/2025

Degree	Type	Year
2501230 Biomedical Sciences	OB	2

Contact

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

You must be enrolled simultaneously, or have taken, the theory subjects corresponding to the contents of the lab

To be able to access the laboratories, it is necessary that the student justify having passed the biosafety and security tests, as found in the Virtual Campus and be aware of and accept the operating rules of the laboratories of the Biosciences School.

Objectives and Contextualisation

The subject "Laboratory II" of the 2nd year of the Degree in Biomedical Sciences:

It is a compulsory subject of the second year that develops basic techniques in biomedical experimentation applied to different areas.
It is composed by seven independent areas or modules, each one with the number of ECTS that is detailed below:

1.- Molecular Biology of the Cell (1 ECTS)

2.- Human Genetics (1 ECTS)

3.- Systems Histology (1 ECTS)

4.- Structure and Function of the Nervous System (1 ECTS)

5.- Immunology (1 ECTS)

6.- Biology of Development and Teratogenicity (0.5 ECTS)

7.- Biomedical bibliography (0.5 ECTS).

This subject is the natural continuation of the subject "Laboratory I". The contents of Laboratory II consist of practical laboratory or classroom work where techniques applicable to solving biomedical problems in different areas will be worked on.

Objectives of the subject:

1) Know basic experimental techniques specific to each of the modules that form the subject.

2) Apply the knowledge acquired in the planning and implementation of research, development and innovation projects in a biomedical research laboratory, a laboratory of a clinical department and in the biomedical industry. Identify and apply appropriate study methodologies for the development of research projects. Plan and implement practically experiments and laboratory analysis procedures in the field of biomedical sciences.

3) Demonstrate an understanding of the bases and elements applicable to diagnostic and therapeutic techniques. To identify and critically evaluate methodologies for the experimental study of diseases.

4) Correct use of laboratory safety protocols and waste management.

5) Be competent in the informational skills considered basic in the scientific field: take advantage of accredited information sources, learn to quote correctly and assess the impact of publications.

Competences

- Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
- 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.
- 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.
- Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
- Read and critically analyse original and review papers on biomedical issues and assess and choose the appropriate methodological descriptions for biomedical laboratory research work.
- Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
- Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
- Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
- Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
- Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
- Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
- Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
- Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.

Learning Outcomes

1. Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
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. Identify and apply suitable functional study methodologies for the development of research projects.
5. Identify and critically evaluate methodologies for the experimental study of diseases.
6. Identify the different components of the immune system: molecules, cells and organs.
7. Identify the principal experimental techniques in cell and molecular biology, genetics and immunology.
8. Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
9. Relate the behaviour, structure and function of chromosomes to human pathology.
10. Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
11. Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
12. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
13. Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
14. Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
15. Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
16. Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
17. Understand techniques of amplification, restriction and hybridation of nucleic acids.
18. Understand the diagnostic techniques based on immunological methods.
19. Understand the processes of genetic manipulation.
20. Understand the techniques for obtaining and observing DNA, chromosomes, proteins, cell organelles and cells.
21. Use immunological techniques.
22. Use optical and electronic microscopy to identify cell types, their components and their principal characteristics.
23. Use procedures for analysing the structure, properties and function of cellular molecules and organelles.
24. Use procedures of organic synthesis, purification, identification and quantification of biologically active compounds, biomolecules and cell organelles.
25. Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.

Content

Compulsory subject of the second year, natural continuation of the subject "Laboratory I", which develops fundamentals of basic techniques in applied biomedical experimentation. The contents of Laboratory II consist of practical laboratory or classroom work where techniques applicable to the resolution of biomedical problems will be worked on in the following modules:

1.- Molecular Biology of the Cell (1 ECTS)

2.- Human Genetics (1 ECTS)

3.- Systems Histology (1 ECTS)

4.- Structure and Function of the Nervous System (1 ECTS)

5.- Immunology (1 ECTS)

6.- Biology of Development and Teratogenicity (0.5 ECTS)

7.- Biomedical bibliography (0.5 ECTS)

Module 1. Molecular Biology of the Cell

Biochemical Submodule - Practice 1 and 2 (50% of the module)

Chromatin extraction and core digestion with micrococal nuclease
Analysis of chromatin digestion. Purification of DNA fragments and observation of the band pattern by agarose gel electrophoresis
Anàlisiepigenètic of chromatin by Real Time PCR (qPCR). Obtaining the melting curve (Tm) of an amplicon.

Cellular Biology Submodule - Practice 3 and 4 (50%)

Determination of the effect of cryoprotectant on cell survival after freezing.

Module 2. Human Genetics

Cytogenetics: lymphocyte culture and obtaining chromosomal preparations
Cytogenetics: chromosomal identification techniques
Molecular cytogenetics: Fluorescent in situ hybridization technique (FISH)
Application of the PCR technique

Module 3. Systems histology

Integumentary system.
Sensory organs.
Cardiovascular device
Respiratory device
Lymphoid organs.
Endocrine glands
Digestive system.
Excretory system.
Male reproductive system.
Female reproductive system

Module 4. Structure and Function of the Nervous System

1. Submodule A - Neuroanatomy (30%)

Practice 1: External morphology. Cerebellum.
Practice 2: Internal morphology. ventricular system
Practice 3: Marrow. Meninges. Vascularization Deals

2. Submodule B - neurohistology (20%)

Practice 1: Organography of the nervous system

3.- Submodule C - Neurophysiology (50%)

Practice 1: Induction pattern of the early expression gene C-FOS in the central nervous system in response to stress
Practice 2: Tests of valuation of antidepressant drugs in animal models
Practice 3: Evaluation of autonomic nervous responses: Polygraph test.

Module 5. Immunology

Separation of mononuclear cells from mouse spleen and cell count
Sowing calculations and stimulations with mitogens
Preparation of human immunoglobulins and dialysis
Pectic design of an ELISA. Quantification of Igs in human serum (ELISA)
Analysis of the lytic function of the complement (CH50 calculation)
Functional Histology of lymphoid organs: observation of microscopy of human lymphoid organs
Problems: Obtainment and flow cytometry. Fundamentals and exercises

Module 6. Biology of Development and Teratogenicity

Fertilization and early stages of development: Model Caenorhabditis elegnas.
Experimental embryology: Model birds
Human embryology: Macroscopic and microscopic analysis of normal and pathological embryonic and fetal specimens

Module 7. Biomedical Bibliography

PubMed

Mendeley

Scopus

Web of Science

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Evaluation	24	0.96	19, 17, 20, 18, 3, 6, 4, 5, 7, 9, 22, 24, 21
Laboratory work	74	2.96	19, 17, 20, 18, 3, 6, 4, 5, 7, 9, 25, 22, 2, 23, 24, 21
Tutoring	3	0.12	4, 7
Type: Autonomous			
Autostudy	10	0.4	19, 20, 18, 4, 5, 7
Preparation of reports	15	0.6	19, 17, 20, 18, 3, 6, 5, 7, 9, 25, 22, 23, 24, 21

The attendance to the classes of this subject is mandatory given that they involve an acquisition of competences based on practical work.

The center of the learning process is the student's work, structured basically in practical classes. The student learns by working, being the teacher's mission to help in this task by providing information or showing the sources where you can get and directing their steps so that the learning process can be carried out effectively. If this is true for any subject, in a totally practical one such as "Laboratory I" it is not only valid, but the student's work becomes a basic necessity 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 must be developed in that semester. In general terms, students must 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 appropriate, small seminars on the technique of interest may be carried out. The seminars have a double mission. On the one hand, the scientific and technical knowledge obtained in the practical classes is worked on, in order to complete their comprehension and to deepen them in developing diverse activities, from the typical resolution of problemesfins to the discussion of practical cases. On the other hand, seminars are the natural forum in which to discuss in common the development of practical work, providing the necessary knowledge to carry 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 the ability to solve problems, beyond the simple realization of an experimental protocol.

Module1- Molecular Biology of the cell

Biochemical Submodule (50%)

PRACTICE 1- Core digestion (obtingutspreviamentpelprofessor) ambNucleasaMicrococal. Preparation of the agarose gel to be used in the second session

PRACTICE 2. Analysis of the digestion by agarose gel electrophoresis. Anàlisiepigenètic

SubmòdulBiologiaCel·lular (50%)

PRACTICE 3. Freezing and thawing cells of a growing cell culture. Determination of viability by Trypan Blue dye. Determination of the effect of cryoprotectant on cell survival after freezing.

Module 2- Human Genetics

1. CYTOOGENETICS: CULTIVATION OF LYMPHOCYTES AND OBTAINING CHROMOSOMAL PREPARATIONS

1.1. FUNDAMENTALS OF CULTIVATION TECHNIQUE

1.2 CULTURE MEDIUM

1.3 OBTAINING CHROMOSOMAL PREPARATIONS

2. CHROMOSOMAL IDENTIFICATION TECHNIQUES

2.1. BANDS G

2.2 To do: (1) Identify chromosomes 21 and 22 and draw them; 2. Idem. elchromosome 7; 3. Idem. chromosome 3

3. TECHNIQUE of fluorescent in situ hybridization

3.1 Denaturation of the PROBE AND CROMOSOMAL PREPARATION

3.2 Hybridization

3.3 WASHING POST-HYBRIDIZATION

3.4 OBSERVATION OF THE RESULTS IN THE FLUORESCENCE MICROSCOPE

4. PCR TECHNIQUE

4.1 PREPARATION OF THE MIX

4.2 LOADING THE PCR PRODUCT IN THE Agarose Gel

4.3 OBSERVATION AND INTERPRETATION OF RESULTS

Module 3. Histology of Systems

1st block:

PRACTICE 1: Integumentary system. Sensory organs (eye and ear). Cardiovascular device
PRACTICE 2: Respiratory system. Lymphoid organs. Endocrine glands

2nd block:

PRACTICE 3: Digestive system.
PRACTICE 4: Excretory device. Reproductive devices for men and women.

Module 4. Structure and Function of the Nervous System

1) Neuroanatomy (30%): students will perform 3 SN dissection practices on human specimens.

2) neurohistology (20%)

3) Neurophysiology (50%)

P3: Evaluation of autonomic nervous responses: Polygraph test.

P4: No early expression: application to the study of the cerebral pattern of induction of c-fos by stress

P5: Experimental models in Psychopharmacology: forced swimming test and antidepressants

Module 5. Immunology

1. SEPARATION OF SPLECKS AND CELLULAR COUNTING

A. Obtaining a cell suspension from rat spleen

B. Isolation of splenocytes by density gradient

C. Cell count and calculation of cell viability

2. Problems: calculation of cell seeding and stimulations with mitogens

Calculate, from a known concentration, the volumes needed to grow and stimulate cells (see the problem to the practice script)

3. PRECIPITATION OF IMMUNOGLOBULINS WITH AMMONIUM SULPHATE

Obtain preparations of the serum gamma globulin fraction (IgM, IgG, IgA). Measure the concentration of Igs using an ELISA.

4. QUANTIFICATION OF HUMAN IGS THROUGH ELISA (ENZYME LINKED immunosorbent Assay).

5. EVALUATION OF CH50 hemolytic COMPLEMENT

6. IMMUNOHISTOLOGY THE lymphoid organs

7. Problems: obtaining monoclonal antibodies and flow cytometry

Mòdul6- Biology of Development and Teratogenicity

PRACTICE 1. Fertilization and early stages of development: Model Caenorhabditis elegans

PRACTICE 2. Experimental embryology: Model birds

PRACTICE 3. Human embryology: Macroscopic and microscopic analysis of normal and pathologicalembryonic and fetal specimens

The practices are aimed at learning techniques applicable to experimental embryology and teratogenesis (practices 1 and 2) and strategies for the interpretation of histological sections of human embryos andfetuses and cases of fetuses with physical congenital defects (practice 3).

Module 7- Biomedical Bibliography

Attendance to training sessions (face-to-face and/or on line) on the different aspects indicated in the program organized jointly by the UAB Libraries Service and the coordination of the Degree.

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
Práctical evaluation	32.2	20	0.8	19, 17, 20, 3, 6, 4, 5, 7, 8, 14, 13, 12, 10, 11, 9, 25, 22, 2, 23, 24, 21
Writing evaluation	66.4	4	0.16	1, 16, 15, 19, 18, 3, 6, 4, 5, 7, 8, 14, 12, 10, 11, 25, 2, 23, 24, 21

Scores:

1. Modules' score: From the weighted sum of the own tests of each module, it is necessary to obtain a final grade superior or equal to 5.0 (scale 0-10) to reach the sufficiency in a module

2. Subject's score: From the weighted sum of the notes of the modules, it is necessary to obtain a final grade equal to or higher than 5.0 (scale 0-10) to achieve proficiency in the subject

Final note: The final evaluation will be the weighted average of the final grades of each module or sub-module.

Exemptions: In cases of second or third enrollment, students who have attained a module grade of 5 or higher (scale 0-10) in previous courses will be exempt from attending a specific module, these notes being applied to the course current.

Module 7- Biomedical Bibliography

The evaluation is based on attendance at the training sessions (there will be control of registration and attendance at the sessions) and a final questionnaire.

- Each training session: 1.5 points (up to a maximum of 6 points)

- Questionnaire: up to 4 points

In all cases, de questionnaire is a mandatory activity. If the questionnaire is not done the maximum score will be 4.5 (regardless the number of training sessions attended).

Single evaluation: This signature, given its typology, does not allow for a single evaluation.

Bibliography

The bibliography and the web links will e included in the practical protocols or, when appropriate, in the Teaching Guide of the corresponding theory subject. They will also be found in the guide of each module posted on the virtual campus.

Software

This subject does not use any specific software.

Language list

Name	Group	Language	Semester	Turn
(PLAB) Practical laboratories	521	Catalan/Spanish	annual	morning-mixed
(PLAB) Practical laboratories	522	Catalan/Spanish	annual	morning-mixed
(PLAB) Practical laboratories	523	Catalan/Spanish	annual	morning-mixed