

Laboratory II

Code: 101906
ECTS Credits: 6

Degree	Type	Year	Semester
2501230 Biomedical Sciences	OB	2	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

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

- 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

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 micrococcal nuclease

Analysis of chromatin digestion. Purification of DNA fragments and observation of the band pattern by agarose gel electrophoresis

Anàlisi epigenètic of chromatin by Real Time PCR (qPCR). Obtaining the melting curve (T_m) of an amplicon.

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

Analysis of the changes, mainly morphological, produced during proliferation, cell differentiation and apoptosis. 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: 1) Somesthetic sensitivity, 2) Reflected activity

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 elegans*.

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

Methodology

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) ambNucleasaMicrococcal. Preparation of the agarose gel to be used in the second session

PRACTICE 2. Analysis of the digestion by agarose gel electrophoresis. Anàlisi epigenètic

Submòdul Biologia Cel·lular (50%)

PRACTICE 3. Observation of proliferation, cell differentiation and apoptosis in nerve cells in culture (cell line PC-12). Observation of the fragmentation and progressive condensation of chromatin in different tissues in apoptotic cells. Observation to fluorescence and electron microscopy of the modifications that occur in apoptotic cells

PRACTICE 4. 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: somesthesia and reflexes

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 and fetuses and cases of fetuses with physical congenital defects (practice 3).

Module 7- Biomedical Bibliography

Attendance to training sessions on the different aspects indicated in the program organized jointly by the UAB Libraries Service and the coordination of the Degree.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Evaluation	24	0.96	17, 15, 18, 16, 3, 11, 8, 9, 12, 13, 20, 22, 19
Laboratory work	74	2.96	17, 15, 18, 16, 3, 6, 11, 8, 9, 12, 13, 23, 20, 2, 21, 22, 19
Tutoring	3	0.12	7, 8, 12, 14
Type: Autonomous			
Autostudy	10	0.4	17, 18, 16, 6, 5, 7, 8, 10, 9, 12
Preparation of reports	15	0.6	17, 15, 18, 16, 1, 3, 4, 7, 11, 10, 9, 12, 13, 23, 20, 21, 22, 19

Assessment

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 as long as the Note of each module is greater than or equal to 3.5 (scale 0-10)

Final note: The final evaluation will be the weighted average of the final grades of each module or sub-module. Why the notes of the modules can be compensated among them, to establish the final grade, it is required to reach at least 3.5 out of 10 in each module and sub-module evaluated (scale 0-10).

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).

It is necessary to attend at least two training sessions to pass the module.

Attendance at a session: Note 2.5 (module not exceeded)

Attendance at two sessions: Note 5

Assistance to three sessions: Note 7.5

Assistance to four sessions: Note 10.0

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Practical evaluation	32.2	20	0.8	17, 15, 18, 1, 3, 6, 5, 4, 7, 8, 10, 9, 12, 13, 14, 23, 20, 2, 21, 22
Writing evaluation	66.4	4	0.16	17, 16, 1, 3, 6, 5, 4, 7, 11, 8, 10, 9, 12, 14, 23, 2, 21, 22, 19

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.