UAB
Universitat Autònoma de Barcelona

Laboratory II

Code: 101906
Credits: 6

2026/2027

Degree programme	Type	Course
Biomedical Sciences	OB	2

Contact lecturer

Name : Vicente Martinez Perea

Email : vicente.martinez@uab.cat

Group languages

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

Prerequisites

You sgolud be enrolled simultaneously, or have taken, the theory subjects corresponding to the contents of the laboratory course.

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

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.

Learning outcomes

- CM29 (Interpret experimental results in a real-world laboratory or company to prepare and defend academic or professional work in the field of biomedicine.) Interpret experimental results in a real-world laboratory or company to prepare and defend academic or professional work in the field of biomedicine.
- KM36 (Describe the main research techniques used in the biomedical sciences.) Describe the main research techniques used in the biomedical sciences.
- KM37 (Describe the fundamentals of the analytical methodology used in the diagnosis of diseases.) Describe the fundamentals of the analytical methodology used in the diagnosis of diseases.
- SM32 (Apply safety and waste management protocols in the biomedical laboratory.) Apply safety and waste management protocols in the biomedical laboratory.

Contents

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)

SPECIFIC CONTENTS

Module 1. Molecular Cell Biology

Submodule: Cell Cycle (Department of Cell Biology) - Practical Sessions 1 and 2 (50% of the module)

Assessment of the effect of cryoprotectants on cell viability following cryopreservation: cell culture techniques, cryogenic stress, and cell death mechanisms.

Submodule: Gene Expression Regulation (Department of Biochemistry) - Practical Sessions 3 and 4 (50% of the module)

Practical Session 1. Chromatin isolation and nucleosome repeat length analysis: digestion of nuclei with micrococcal nuclease and preparation of soluble chromatin fractions. Analysis by agarose gel electrophoresis.

Practical Session 2. Quantification and spectrophotometric analysis of nucleic acids: DNA quantification and quality assessment using spectrophotometry (NanoDrop).

Practical Session 3. Epigenetic analysis of chromatin by qPCR: assessment of chromatin accessibility to micrococcal nuclease at two genes, one transcriptionally active and one silenced.

Module 2. Human Genetics

Cytogenetics: lymphocyte culture and preparation of metaphase chromosome spreads.

Cytogenetic banding and chromosome identification techniques.

Molecular cytogenetics: fluorescence in situ hybridization (FISH).

Applications of PCR-based techniques.

Module 3. System Histology

Cardiovascular system.

Hematopoiesis.

Immune system.

Respiratory system.

Urinary system.

Digestive system.

Sensory organs.

Integumentary system.

Endocrine system.

Male reproductive system.

Female reproductive system.

Module 4. Structure and Function of the Nervous System

1. Submodule A - Neuroanatomy (30%)

Practical Session 1: External morphology of the cerebellum.

Practical Session 2: Internal morphology of the ventricular system.

Practical Session 3: Spinal cord anatomy, meninges, vascularization, and major tracts.

2. Submodule B - Neurohistology (20%)

Practical Session 1: Systematic histological organization of the nervous system.

3. Submodule C - Neurophysiology (50%)

Practical Session 1: Induction of the immediate early gene *c-FOS* in the central nervous system in response to stress.

Practical Session 2: LabAxon - advanced analysis of the action potential and its ionic basis (computer-based simulation, computer lab).

Practical Session 3: Assessment of autonomic nervous system responses: polygraph-based evaluation.

Module 5. Immunology

Isolation of mononuclear cells from sheep blood and cell counting using density gradient centrifugation.

Preparation and dialysis of human immunoglobulins.

Quantification of human serum IgG using ELISA.

Assessment of complement-mediated lytic activity in human serum (CH50 assay).

Flow cytometry: phagocytosis assay.

Module 6. Developmental Biology and Teratology

Fertilization and early developmental stages: *Caenorhabditis elegans* model.

Experimental embryology: avian model systems.

Human embryology: macroscopic and microscopic analysis of normal and pathological embryonic and fetal specimens.

Module 7. Biomedical Literature and Databases

PubMed

Mendeley

Scopus

Web of Science

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Preparation of reports	14	0.56	CM29, KM36, KM37
Autostudy	10	0.4	CM29, KM36, KM37

Tutoring	7	0.28	CM29, KM36, KM37
Evaluation	14	0.56	CM29, KM36, KM37
Laboratory work	81	3.24	CM29, KM36, KM37, SM32

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.

Module 1 - Molecular Cell Biology

Submodule Cell Cycle (50% of the total module)

PRACTICAL 1 and 2. Freezing and thawing of cells from a growing cell culture. Viability assessment using Trypan Blue dye. Determination of the effect of cryoprotectants on cell survival after freezing.

Submodule gene expression regulation (50% of the total module)

PRACTICAL 3. Digestion of nuclei (previously obtained by the instructor) with micrococcal nuclease. Preparation of the agarose gel to be used in the second session.

PRACTICAL 4. Analysis of digestion by agarose gel electrophoresis. Epigenetic analysis.

Module 2 - Human Genetics

CYTOGENETICS: LYMPHOCYTE CULTURE AND PREPARATION OF CHROMOSOMAL SPREADS

1.1. PRINCIPLES OF CULTURE TECHNIQUES

1.2 CULTURE MEDIUM

1.3 PREPARATION OF CHROMOSOMAL SPREADS

CHROMOSOME IDENTIFICATION TECHNIQUES

2.1. G-BANDING

2.2 To be carried out: (1) Identify chromosomes 21 and 22 and draw them; 2. same for chromosome 7; 3. same for chromosome 3

FLUORESCENCE IN SITU HYBRIDIZATION TECHNIQUE

3.1 DENATURATION OF THE PROBE AND CHROMOSOMAL PREPARATION

3.2 HYBRIDIZATION

3.3 POST-HYBRIDIZATION WASHES

3.4 OBSERVATION OF RESULTS UNDER THE FLUORESCENCE MICROSCOPE

PCR TECHNIQUE

4.1 PREPARATION OF THE MIX

4.2 LOADING OF THE PCR PRODUCT ONTO THE AGAROSE GEL

4.3 OBSERVATION AND INTERPRETATION OF RESULTS

Module 3. Histology of Systems

1st block:

PRACTICAL 1: Cardiovascular system, hematopoiesis, and immune system.

PRACTICAL 2: Respiratory system. Urinary system.

2nd block:

PRACTICAL 3: Sensory organs. Integumentary system.

PRACTICAL 4: Endocrine system. Male and female reproductive systems.

Module 4. Structure and Function of the Nervous System

Neuroanatomy (30%): students will perform 3 dissection practical sessions of the NS on human specimens.

Neurohistology (20%): students will carry out a practical session on microscopic visualization and identification of different areas and regions of the CNS and PNS.

Neurophysiology (50%)

P3: Assessment of autonomic nervous responses: polygraph test.

P4: Immediate early genes: application to the study of stress-induced cerebral expression pattern of c-fos.

P5: Neurophysiology of sensory systems.

Module 5. Immunology

P1. LYMPHOCYTE SEPARATION AND CELL COUNTING

A. Isolation of lymphocytes from blood using density gradient centrifugation

B. Cell counting and cell viability

P2. PHAGOCYTOSIS ASSAY AND FLOW CYTOMETRY

Phagocytosis assay using a monocytic cell line

Cell labeling with antibodies

Analysis by flow cytometry

P3. PURIFICATION OF IMMUNOGLOBULINS AND IgG QUANTIFICATION (ELISA)

A. Preparation of the gamma globulin fraction from human serum using ammonium sulfate precipitation: dialysis

B. Quantification of human IgG in the different fractions obtained using ELISA (enzyme-linked immunosorbent assay)

P4. EVALUATION OF HEMOLYTIC COMPLEMENT CH50

A. Dilution series

B. Hemolysis assay with sensitized erythrocytes

C. Determination of CH50

Module 6 - Developmental Biology and Teratology

PRACTICAL 1. Fertilization and early stages of development: *Caenorhabditis elegans* model

PRACTICAL 2. Experimental embryology: avian model

PRACTICAL 3. Human embryology: macroscopic and microscopic analysis of normal and pathological embryonic and fetal specimens

The practical sessions are designed for learning techniques applicable to experimental embryology and teratology (practicals 1 and 2), as well as strategies for interpreting histological sections of human embryos and fetuses and cases of fetuses with congenital physical defects (practical 3).

Module 7 - Biomedical Literature

Attendance at training sessions (in-person and/or online) on the various topics outlined in the syllabus, jointly organized by the UAB Library Service and the Degree Coordination.

Use of AI

For this subject, the use of Artificial Intelligence (AI) technologies is allowed exclusively in support tasks, such as bibliographic or information search, proofreading or translations. The student will have to clearly identify which parts have been generated with this technology, specify the tools used and include a critical reflection on how these have influenced the process and the final result of the activity. Non-transparency of the use of AI in this evaluable activity will be considered academic dishonesty and may result in a partial or total penalty in the grade of the activity, or higher penalties in serious cases.

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

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes

Práctical evaluation	32.2	20	0.8	CM29, KM36, KM37, SM32
Writing evaluation	66.4	4	0.16	CM29, KM36, KM37

Scores:

1. Modules' score: From the weighted sum of the own tests of each module/submodule, it is necessary to obtain a final grade superior or equal to 5.0 (scale 0-10) to reach the sufficiency in a module. Averaging between submodules is only permitted when the grade for each individual submodule is 4.0 or higher.

2. Passing grade for the course: Based on the weighted sum of the module grades, students must obtain a final grade of 5.0 or higher (on a 0-10 scale) to pass the course. Module grades below 5.0 cannot be compensated for by higher grades in other modules, as the different subject matter covered in each module does not allow for such compensation.

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.

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

Any irregularity in an assessment activity (academic fraud, plagiarism, or the improper use of AI, unless such use is expressly authorized in the course syllabus) that may result in a significant change to the grade will lead to that assessment activity being awarded a grade of 0. If the course syllabus establishes that obtaining a minimum grade in that assessment activity is an essential requirement for passing the course, or if multiple irregularities occur in the assessment activities of the same course, the final grade for the course will be 0. In addition, disciplinary proceedings may be initiated against any student who commits any of these irregularities.

Module 1. Molecular Cell Biology

At the end of Session 2 (Submodule 1) and Session 4 (Submodule 2), students must complete an examination consisting of questions in various formats. The final grade for this module will be the average of these two marks. In order to calculate the average, students must obtain a minimum grade of 4.0 in each of the two examinations. Students who do not achieve this minimum grade must take the resit examination for the submodule(s) not passed. To pass this module, the resulting average grade must be 5.0 or higher.

Module 2. Human Genetics

Examination on the techniques performed and the results obtained.

Module 3. Systems Histology

- Practical examination using the microscope and identification of histological images at the end of each

practical session.

Module 4. Structure and Function of the Nervous System

1. Submodule A - Neuroanatomy (30%) - Oral examination using anatomical specimens or photographs of specimens from the dissection room. Students must identify a labelled structure or explain its relationship to another structure or its function. No resit examination.
2. Submodule B - Neurohistology (20%) - Practical examination using the microscope and identification of histological images at the end of the practical session. No resit examination.
3. Submodule C - Neurophysiology (50%) - Examination consisting of questions in various formats, with the possibility of a resit examination.

Module 5. Immunology

Written assessment consisting of questions in various formats at the end of the practical sessions, with the possibility of a resit examination.

Module 6. Developmental Biology and Teratology

Examination consisting of short-answer questions, many of which refer to images, related to the activities carried out during the practical sessions. The assessment of these practical sessions takes place together with the examination for the *Developmental Biology and Teratology* course (PLAB I with the first midterm examination and PLAB II-PLAB III with the second midterm examination). A resit examination is available on the date scheduled for the *Developmental Biology and Teratology* course resit examination.

Module 7. Biomedical Literature

Online exercises and quizzes at the end of the practical sessions. No resit examination.

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.

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this link. To access the information, you will need to enter the course CODE

Type of teaching	Group	Language	Semester	Shift
(PLAB) Practical laboratories	521	Catalan/Spanish	annual	morning-mixed

(PLABs) Suport a les pràctiques de laboratori	521	Catalan/Spanish	annual	morning-mixed
(PLAB) Practical laboratories	522	Catalan/Spanish	annual	morning-mixed
(PLABs) Suport a les pràctiques de laboratori	522	Catalan/Spanish	annual	morning-mixed
(PLAB) Practical laboratories	523	Catalan/Spanish	annual	morning-mixed
(PLABs) Suport a les pràctiques de laboratori	523	Catalan/Spanish	annual	morning-mixed