

Laboratory III

Code: 101945
ECTS Credits: 3

Degree	Type	Year	Semester
2500890 Genetics	OB	2	1

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: Yes

Prerequisites

- It is mandatory to have taken -o being currently taking- the theoretical subjects related to the experimental work developed here.
- Biosecurity and security tests at 'campus virtual' need to be passed. The student must prove knowledge and acceptance of the Bioscience laboratory guidelines.
- It is necessary to go through the theoretical content of each module before the day of the practical classes.
- Wearing a lab coat is mandatory. It is not possible to enter to the lab without a lab coat.
- Attendance is mandatory.
- Students should come to the class following the assigned schedule. Changes in the original schedule need to be approved by the corresponding professor and in all cases before the starting of the classes.

Objectives and Contextualisation

The Integrated Laboratory III is the third course in a set of 6 which are distributed along 6 semesters of the first three courses of the degree of genetics. These subjects aim to give a solid foundation of experimental procedures, techniques and skills of genetics and related sciences. The practical work help to reinforce the theoretical concepts acquired in the theory, and allow us to understand the essential dialogue between theory and experimentation that have given rise to the body of knowledge that constitutes the science of genetics.

The Integrated Laboratory III has as objectives the acquisition of experimental skills in 4 specific modules of content:

- Molecular Biology of Eukaryotes
- Molecular Biology of Prokaryotes
- Cytogenetics
- Scientific Documentation

Objectives Molecular Biology of Eukaryotes:

- Understand and use the basic nucleic acids' extraction, manipulation and amplification techniques.
- Understand how to use different detection techniques of DNA sequences.

- Apply the acquired knowledge to design an experiment in the field of Genetics.
- Learn how to decide the appropriate experimental techniques to develop a research project.

Objectives Molecular Biology of Prokaryotes:

The module of Molecular Biology of Prokaryotes gives the basics prokaryotes genetics. Their specific objectives are as follows:

- Know how to use the various techniques of incorporation of exogenous DNA in prokaryotes.
- Learn about systems that allow for the obtaining of new bacterial strains by mutagenesis processes in random or targeted mutagenesis.
- Know how to use tools that allow the study of gene expression in prokaryotes.

Objectives of Cytogenetics:

- Learning of the protocols for chromosomal preparations.
- Learning techniques for chromosome identification.
- Check the effects of ionizing radiation on the karyotype.

Objectives of Scientific Documentation:

The general objective is to provide a theoretical and practical base of knowledge that will enable the student to acquire basic information skills related to the search and information retrieval, as well as the resolution of information needs intrinsic to the scientific activity.

Specific objectives:

- Know the types of sources of bibliographic information.
- Learn how to solve information needs in the field of genetics and related using the most appropriate bibliographical resources.
- Know strategies to search and retrieve bibliographic information in electronic format.
- Gain criteria to question the reliability of the bibliographical sources.

Competences

- Apply knowledge of theory to practice.
- Apply scientific method to problem solving.
- Assume ethical commitment
- Be able to organise and plan.
- Define mutation and its types, and determine the levels of genic, chromosomal and genomic damage in the hereditary material of any species, both spontaneous and induced, and evaluate the consequences.
- Describe and identify the structural and functional characteristics of nucleic acids and proteins including their different organisational levels.
- Design and execute complete protocols of the standard techniques that form part of molecular genetics instruments: purification, amplification and sequencing of genomic DNA from biological sources, genetic engineering in microorganisms, plants and animals.
- Develop self-directed learning.
- Understand and describe the structure, morphology and dynamics of the eukaryotic chromosome during the cell cycle and meiosis.
- Work individually and in teams.

Learning Outcomes

1. Apply biochemical and genetic engineering techniques to identify and characterise nucleic acids and proteins.
2. Apply in situ human chromosome hybridisation techniques, with and without fluorescence.
3. Apply knowledge of theory to practice.

4. Apply scientific method to problem solving.
5. Assume ethical commitment
6. Be able to organise and plan.
7. Design and apply in vitro DNA amplification technologies by means of a polymerase chain reaction (PCR) in different specific contexts.
8. Design and apply the methods and procedures of in vivo DNA amplification: extraction, digestion, transfer, marking, hybridisation, detection, isolation, ligation, transformation and selection.
9. Detect the nature of genic mutations and determine the phenotypical consequences.
10. Develop self-directed learning.
11. Extract and purify DNA in human and animal samples.
12. Perform in vivo and in vitro mutagenesis.
13. Prepare cultures of human lymphocytes.
14. Prepare, observe and recognise the metaphase chromosomes of a normal human karyotype and with chromosomal disorders.
15. Use restriction enzymes to generate molecules of recombinant DNA.
16. Use transposons and other genetic elements to obtain mutants.
17. Work individually and in teams.

Content

Module Molecular Biology of Eukaryotes

- Session 1: Genomic DNA extraction and amplification by PCR.
- Session 2: Agarose gel electrophoresis. DNA Dot Blot preparation and hybridization.
- Session 3: Dot Blot development, miniprep and plasmid enzymatic digestion.
- Session 4: Electrophoresis and results analysis.

Module Molecular Biology of prokaryotes

- Session 1 (5 h) transfer of genetic material in prokaryotes.
- Session 2 (3 h). Processes of mutagenesis and recombination to obtain new strains.
- Session 3 (4 h). Use of mobile genetic elements to obtain mutants.
- Session 4 (3 h). Control of gene expression in prokaryotes.

Module cytogenetics

- First session

General introduction to practices

Preparation of chromosome spreads of human monocytes

- Second session

Uniform staining: microscopic analysis

Uniform staining: evaluation of the effects of ionizing radiation

- Third session

Human karyotype: features and nomenclature

G Bands: microscopic analysis

- Fourth session

Fluorescent in situ hybridization (FISH) on extensions of human chromosomes

Module Scientific Documentation

The module is divided into two sessions, two hours each, to be held in computerized classrooms. The contents of each session are:

Session 1. Search in bibliographic catalogues: the use of subject headings. Location of articles and bibliographic catalogues journal magazines. Search engine optimization of monographs. Location of electronic publications (books and digital magazines). Use of the database contents.

Session 2. Structure of academic articles. Search in databases on Science and technology of the CSIC, academic repositories in open access, academic search engines and databases of theses.

"*Unless the requirements enforced by the health authorities demand a prioritization or reduction of these contents."

Methodology

The subject is taught in small groups of students (maximum 20 per session) in the laboratory. Students have a manual or practice guide for each Module. It is necessary to read the corresponding part of each session carefully before starting the practice to obtain the maximum advantage. Students will have to produce the results obtained.

Molecular Biology of Eukaryotes Methodology

Autonomous learning. The student learns by working on the different experimental procedures while being guided at all times by the responsible teacher, who establishes the objectives of the session.

The students must elaborate, analyze the obtained results and answer the different questions raised in the lab's workbook.

Molecular Biology of Prokaryotes

The module will be taught in the laboratory and in small groups of students (with a maximum of 22 students per session).

Students will have before the completion of the sessions associated to the Molecular Biology module of Prokaryotes of a specific Practices Manual that they will find in the Virtual Campus or where the teaching staff indicates.

To carry out the practices associated to the module of Molecular Biology of Prokaryotes the students will work in pairs.

At the beginning of each session the teacher will make a brief theoretical explanation of the content of the practices that will be carried out as well as the experiences to be carried out by the students.

In order to achieve good performance and acquire the competencies corresponding to this module, it is essential that the student read a comprehensive reading of the Practices Manual, familiarizing with the practices that will be carried out and with the methodology that will be applied in each case.

Cytogenetics Module

The Cytogenetics module will be given at the C2/ 090 laboratory from 9 a.m. to 12 p.m. In these sessions the students will be divided into three groups.

The student must consult which group they belong to and attend classes corresponding to the assigned group. The students will work in pairs and will have to attend the group of practices assigned obligatorily.

Only occasional changes will be accepted as long as they are balanced (a student from a group for a student from another group).

If a student has not been able to perform a practice session with his group, he can retrieve it by attending another group, as long as the group in question has free spaces.

The students will have a guideline of practices (Virtual Campus of the subject) that they will have to carry out to carry out the practices.

To facilitate the understanding of the contents and a good development of the classes it is advisable for the student to read the practice guideline before each session.

During the elaboration of the practices the students will have to solve in person exercises facilitated by the professor.

These exercises must be delivered at the end of each session.

Module Scientific Documentation

Each session will include a brief part of theoretical exposition and a second of a practical type where the student will have to perform exercises related to the consultation of bibliographic sources and the resolution of informational needs.

The issues to be resolved will always be presented contextualized within the thematic field of genetics related sciences.

"*The proposed teaching methodology may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities."

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Aula d'Informàtica Mòdul Documentació Científica	4	0.16	4, 3, 5, 10, 6, 17
Laboratori Mòdul Biologia Molecular de Procariotes	15	0.6	4, 3, 1, 9, 12, 6, 17, 16
Laboratori Mòdul Citogenètica	15	0.6	4, 2, 5, 13, 14, 6, 17
Laboratori Mòdul Biologia Molecular d'Eucariotes	15	0.6	4, 3, 1, 5, 10, 8, 7
Type: Supervised			
Tutories individuals	2	0.08	
Type: Autonomous			
Estudi	16	0.64	
Libreta Laboratori	2	0.08	

Assessment

Molecular Biology of Eukaryotes Evaluation

Attendance is mandatory and, therefore, an absence without justification will result in the non-evaluation of the module. A justified cause could be health problems (a medical certificate must be brought to justify the absence) or serious personal problems. In these cases, the session will be attended whenever possible. The laboratory sessions will be evaluated by an exam that will take place after the 4th session and will represent

80% of the final grade. The attitude and work of the student in the laboratory will also be evaluated, representing 20% of the total grading.

To pass the module it is necessary to pass each evaluation activity with a grade higher than 5.

Molecular Biology of Procariotas Module

In the evaluation of the Molecular Biology module of Procariotas, two aspects will be taken into account: on the one hand, the note obtained in a questionnaire that will be done at the end of session 5 and which will refer to all the practices that make up this module, and On the other, the achievement of the objectives set in each of the programmed practices will also be valued.

The questionnaire will represent 70% of the final grade of the module while the remaining 30% will depend on the evaluation of the results obtained and the experimental work performed.

Cytogenetics Module

The module's note will be obtained through the arithmetic mean of the four exercises performed during the laboratory sessions. Taking into account the mandatory nature of the practices, the lack of unjustified assistance implies a penalty in the final note of the module:

- Missing one day implies a reduction of 30% in the practice note.
- Missing two days implies 60% uneducation in the practice note.
- Missing to three or more days implies a zero in the practice note.

This penalty is exempt from those students who can not attend the session of their group for just cause. Health problems are justified because the medical certificate must be carried out by the practice coordinator or serious personal problems. In this case the practice will recover the practice whenever possible.

Scientific Documentation Module

To pass the module it is essential to attend both sessions, deliver within the established period the two practical exercises provided and conduct a written test. The attendance and realization of the practical exercises supposes 20% of the final qualification. The written test means the remaining 80%.

To pass the subject, it is necessary to first approve each module with a mark ≥ 5 . Students who do not pass the different modules of the subject or want to improve their note can present themselves on the scheduled date for the subject's recovery evaluation. The resentment of the student in the examination of improvement of note entails the renunciation of the qualification previously obtained. Students who have not passed one of the modules after the recovery assessment will not approve the subject. However, it will not be necessary for a repeat student to carry out the teaching activities or the evaluations of that module passed after the second enrollment. Repeaters will only have to evaluate the concrete module that they have not passed. This exemption will be maintained for a period of three additional license plates. The final grade is the average of the notes of each module.

Not evaluable

The "Not Evaluable" rating will be obtained when the number of evaluation activities performed is less than 50% of the programmed ones.

To be eligible for the retake process, the student should have been previously evaluated in a set of activities equaling at least two thirds of the final score of the course or module. Thus, the student will be graded as "No Avaluable" if the weighthin of all conductedevaluation activities is less than 67% of the final score.

Attendance to practical sessions is mandatory. Students missing more than 20% of programmed sessions will be graded as "No Avaluable".

"*Student's assessment may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities."

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Biologia Molecular de Procariotes. Qüestionaris. Avaluació continuada dels resultats experimentals	30%	1.8	0.07	4, 9, 12, 6, 16
Biología Molecular de Eucariotas. Qüestionaris. Avualuació continuada dels resultats experimentals	30%	1.8	0.07	4, 3, 1, 5, 10, 8, 7, 11, 15
Citogenètica. Qüestionaris. Avaluació continuada dels resultats experimentals	30%	1.8	0.07	4, 2, 5, 13, 14, 6, 17
Documentació Científica	10%	0.6	0.02	4, 3, 5, 10, 6, 17

Bibliography

Molecular Biology of Eukaryotes Bibliography

Included in the laboratory workbook, which is available on the Virtual Campus.

Molecular Biology of Prokaryotes

Laboratory workbook available on the Virtual Campus

Cytogenetics

Laboratory workbook available on the Virtual campus.

Scientific Documentation

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3. CASTILLO, L. "Tema 3: fuentes y recursos de referencia" [En línea]. [Consulta: 09-07-2014]. Disponible a: <http://www.uv.es/macass/SR3.pdf>
4. CORDÓN, J.A, et al. Nuevas fuentes de información: información y búsqueda documental en el contexto de la web 2.0. Madrid: Pirámide, 2010.
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<http://www.edukanda.es/mediatecaweb/data/swf/592.swf>
9. JUNCA, M. "Sistemas de clasificación documentales" [En línea]. Edukanda: recursos informativos en red. 2010, 16 de juny. [Consulta: 06-07-2014]. Disponible a:
<http://www.edukanda.es/mediatecaweb/data/swf/594.swf>
10. TORRES RAMIREZ, I. Las fuentes de información. Estudios teórico