

## Integrated Laboratory V

Code: 101943  
 ECTS Credits: 3

**2025/2026**

Degree	Type	Year
Genetics	OB	3

### Contact

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### Teaching groups languages

You can view this information at the [end](#) of this document.

### 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 V is the fifth 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 V has as objectives the acquisition of experimental skills in 3 specific modules of content:

- Genomics
- Human Genetics
- Quantitative genetics and improvement

#### Genomics

The main objective of Genomics module is to understand the process of Assembly, annotation and analysis of genomic sequences. Apart from learning to work with DNA sequences and proteins also will acquire knowledge about the structure and the characteristics of the various functional elements that can be found in a genome.

#### Human Genetics

The aim of the module of human genetics is to know how to identify genetic mutations and polymorphisms related to the generation of diversity and the pathological processes. Through these practices, the student will acquire skills in the application of instrumental, molecular and analytical techniques.

#### Quantitative genetics and improvement

The aim of this module is to help you understand the principles of Quantitative genetics and its application in the selection, as well as the availability of tools for the identification of individual genes that determine the complex characters.

## Competences

- Appreciate the importance of quality and a job well done.
- 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.
- Design and interpret studies associating genetic polymorphisms and phenotypical characters to identify genetic variants that affect the phenotype, including those associated to pathologies and those that confer susceptibility to human illnesses or those of other species of interest.
- Know and apply the 'omic' tools of genomics, transcriptomics and proteomics.
- Measure and interpret the genetic variation in and between populations from a clinical, conservational and evolutionary perspective, and from that of the genetic improvement of animals and plants.
- Perform genetic diagnoses and assessments and consider the ethical and legal dilemmas.
- Use and interpret data sources on the genomes and macromolecules of any species and understand the basics of bioinformatics analysis to establish the corresponding relations between structure, function and evolution.

## Learning Outcomes

1. Analyse and interpret human genetic variation.
2. Apply and interpret simulation programs to improve livestock farming.
3. Apply global analysis software to the integration, representation and modelling of networks for interconverting biological information.
4. Apply techniques for the genetic engineering of microorganisms, plants and animals in specific genetic, medical and agricultural problems
5. Apply the basic common techniques of a human genetics laboratory.
6. Appreciate the importance of quality and a job well done.
7. Design the methodology, sampling and selection of genetic markers and the statistical analyses required in an association study.
8. Detect polymorphisms associated to illnesses and other phenotypical characters of interest in humans and livestock.
9. Determine the base sequence of a DNA segment.
10. Enumerate and describe the contents of databases containing information of relevance to the different fields of genetics and perform advanced research.
11. Perform genetic diagnoses and assessments on the basis of molecular analysis of diagnostic mutations.
12. Perform tests to identify individuals or specimens using their genetic fingerprint.
13. Predict the risk of the genetic transmission of illnesses or of other characters of interest by analysing the genealogies of humans and livestock.
14. Provide genetic warnings by detecting markers that are associated to illnesses.
15. Use databases on haplotype variation and genotype-phenotype association in humans and livestock.
16. Use statistical techniques and available software to perform association studies.

## Content

### Module of Genomics

The module is organized in 5 sessions of 3 hours each that will take place in the computer room. The work will consist of the Assembly, the annotation and analysis of a sequence. Based on initial data, the practice will be continuing along the 5 sessions so that each of them will be one more step in the process or will examine a different aspect of the sequence. The work will be distributed in the following way:

Session 1. Assembly

Session 2. Scaffolding

Session 3. gene annotation Ab initio and by homology

Session 4. Annotation of genes with RNA-seq

Session 5. Functional analysis and discussion

### Module of Human Genetics

The module is organized in 4 sessions of 4 hours each that will be carried out in the laboratory. The students will go through three possible cases occurring in a genetics laboratory: case of prenatal diagnosis, case of leukemia, population screening for a mutation with possible applications (e.g. in the pharmacogenetics or Nutrigenetics). To respond to these three situations several techniques will be used, such as conventional cytogenetics, fluorescence in situ hybridization (FISH), polymerase chain reaction (PCR) and restriction fragment length polymorphisms (RFLPs).

### Module of Quantitative genetics and improvement

GQM module is organized in 5 sessions that will take place in the computer room. The sessions will be synchronic with the theory classes (see calendar), so that the student may work and reflect the essential concepts and methodologies of the topic. The sessions are the following:

Session 1. Visit to the UAB Faculty of Veterinary Medicine farm (3 h).

Session 2. Genome-Wide Association Study (GWAS) (3h).

Session 3. BLUP (3h).

Session 4. Response to selection (3 h).

Session 5. Genomic evaluation of breeding stock (3 h).

## Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Genomics Module	15	0.6	3, 9, 10, 6
Human Genetics Module	16	0.64	1, 5, 4, 8, 14, 11, 6
Quantitative Genetics Module.	15	0.6	1, 2, 8, 7, 13, 15, 16, 6
Type: Supervised			

Individual tutorials	1	0.04
Type: Autonomous		
Laboratory notebook	5	0.2
Study	23	0.92

The subject is taught in small groups of students (maximum 20 per session) in the laboratory or computer rooms. 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 attend the assigned group of internships 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.

#### Genomics Module

Self-guided learning guided by the teacher / a by the practitioner. Students will have to elaborate the data, interpret the results obtained, and respond to the different questions raised in the practice guideline.

#### Human Genetic Module

The student will perform the experimental work independently following the practice guideline and with the help of the practice lecturer. After obtaining the results, these will have to be analysed and interpreted. In the practicals guide, there will be some questions to help with this analysis and interpretation of the results.

#### Quantitative Genetics Module

Each session begins with an introduction by the teacher and then the student must follow the practice guidelines and obtain their own results, always under the supervision of the teacher.

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	Weighting	Hours	ECTS	Learning Outcomes
Genomics module. Continuous evaluation of the results worked	33.3%	0	0	3, 9, 10
Human Genetic Module. Continuous evaluation of the results worked	33.33%	0	0	1, 5, 4, 8, 7, 14, 11, 12, 13, 15, 6
Quantitative Genetics Module. Continuous evaluation of the results worked	33.3%	0	0	2, 8, 7, 11, 12, 13, 15, 16, 6

Attendance at practicals is compulsory and therefore an absence without a justified reason may lead to the non-e

Justified cause means health problems (you will need to bring the corresponding medical certificate to the intern:

If the justified absences exceed 25% of the sessions of any of the modules, the subject will be graded as Not As

#### Genomics Module

The practices will be evaluated by delivering the results obtained during the practice that will have to be presented in a clear and understandable way.

The correction of the data obtained will be assessed. The attitude and work of the student in the classroom will also be taken into account.

#### Human Genetics Module

The practices will be evaluated by delivering the questions of the practice script and the results obtained during the practice. The interpretation that is made of the obtained data will be valued especially. The attitude and work of the student in the laboratory will also be taken into account.

#### Quantitative Genetics Module

At the end of each practical session, students' level of achievement will be assessed through the completion of exercises, the preparation of a report, or any other form of evidence indicated by the instructor in charge. The assessment will consider the accuracy in solving the proposed questions, the clarity of the comments and conclusions, as well as the formal presentation. The student's attitude during the practical sessions will also be evaluated.

To pass the course, it is necessary to first approve each module with a mark  $\geq 5$ . Students who do not pass the different modules of the course will have the opportunity to retake them on the scheduled resit date.

Any student who has not passed a module after the resit assessment will not pass the course. However, repeat students will not be required to complete the learning activities or assessments for any module already passed, starting from their second enrollment. Repeat students will only need to be assessed on the specific module(s) not yet passed. This exemption will remain valid for up to three additional enrollments.

The final grade is the average of the grades from each module.

Not graded: The Not graded qualification will be obtained when the number of assessment 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 equalling at least two thirds of the final score of the course or module.

Thus, the student will be graded as "No Avaluable" if the weight of all conducted evaluation activities is less than 67% of the final score.

Attendance to practical sessions is mandatory. Students missing more than 25% of programmed sessions will be graded as "No Avaluable".

Students who take the single assessment must do the laboratory practices in face-to-face sessions, as they are t

This unique assessment system will be applied to modules 1 (Genomics), 2 (Human Genetics) and 3 (Quantitati

The grade obtained in the synthesis test is 50% of the grade of the corresponding module. The report or memory  
If the practice is done with a partner (partner) who is not included in the si  
The single assessment test will take place on a date agreed between the

The same criterion will be applied to approve the subject and the same recovery system as for the continuous as

## **Bibliography**

### Genomics Module

Included in the practice guideline that is available to students on the Virtual Campus.

### Human Genetics Module

- Genetic Variation: a laboratory manual. Edited by M.P. Weiner, S. B. Gabriel, J C. Stephens (2007). Cold spring Harbor Laboratory Press, New York, USA.
- Molecular Cytogenetics. Protocols and Applications. Edited by Y-S. Fan (2002). Humana Press Inc., Totowa, New Jersey, USA.
- Human Cytogenetics. Constitutional Analysis. Edited by D.E. Rooney (2001). Third edition. Oxford University Press, Oxford, UK.
- Human Cytogenetics. Malignancy and Acquired Abnormalities. Edited by D.E. Rooney (2001). Third Edition. Oxford University Press, Oxford, UK.

### Quantitative Genetics Module

Included in the practice guideline that is available to students on the Virtual Campus.

## **Software**

MEGA (<https://www.megasoftware.net/>)

PLINK	PLINK 1.9 beta
(P2)	<a href="https://www.cog-genomics.org/plink/1.9/">https://www.cog-genomics.org/plink/1.9/</a>
	GCTA
	<a href="http://www.mathgen.com/gcta.html">Windows gcta-1.94.1-Win-x86_64.zip</a>

<https://yanglab.westlake.edu.cn/software/gcta/#Download>

The source code are released under GPL v3

R for windows

RStudio

Notepad++

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R <https://cran.r-project.org/bin/windows/base/>

(P3 y P4)

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Genup <http://www-personal.une.edu.au/~bkinghor/genup.htm>

(P5)

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## Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this [link](#). To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PLAB) Practical laboratories	631	Catalan/Spanish	first semester	afternoon
(PLAB) Practical laboratories	632	Catalan/Spanish	first semester	afternoon
(PLAB) Practical laboratories	633	Catalan/Spanish	first semester	afternoon