

Degree programme	Type	Course
Genetics	OB	2

Contact lecturer

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Group languages

You can consult this information at the [end](#) of the 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

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

- Population Genetics

- Mutagenesis
- Programming principles
- Developmental Biology
- Scientific documentation

OBJECTIVES

Module of Population genetics

Two are the main objectives of this module: (1) understanding the factors that modulate the genetic variation in the populations and (2) learn how to describe the nucleotide variation of a gene. For the first objective the POPULUS 5.4 software package will be used, which allows to simulate different population processes and provides a graphical representation of the results. For the second, students will employ the Polymorphism Diversity Analysis Software (PDA) developed by researchers at the Genetics Unit.

Module of Mutagenesis

The main objectives of the Mutagenesis module are: To carry out a small biomonitoring pilot study in humans by determining the induction and origin of the micronuclei observed in desquamation cells of the oral mucosa, and to find out their possible relationship with polymorphisms of the glutathione-S transferase gene.

Module of Programming principles

The current scenario of research in the genetic field requires that the researcher know and use computer tools. How genetic information is stored? How can you extract this information flexibly? How to create programs to manipulate and analyze genetic data?

The objectives of the module are to acquire the programming principles to create useful programs in genetic research.

- Learning to program with the Python language
- Applying this instrumental capacity to the processing of genetic data
- Promoting the connection between the computer tools and the genetic data, a key aspect of the bioinformatics research
- Understanding a programme written in R programming language and being able to run it or modify it

Module of Scientific Documentation

This module aims to provide a general theoretical and practical basis to deep into the use of information resources specialized in genetics and related disciplines. The specific objectives of the module are:

Learn how to solve information needs in the field of genetics and related sciences through the use of bibliographic resources.

Know how to propose strategies for the search and retrieval of information on electronic sources.

Learning outcomes

- CM18 (Integrate experimental techniques and bioinformatics tools for the collection, processing and preliminary analysis of biological data) Integrate experimental techniques and bioinformatics tools for the collection, processing and preliminary analysis of biological data
- CM19 (Design experimental strategies and data analysis procedures for solving research problems in genetics.) Design experimental strategies and data analysis procedures for solving research problems in genetics.
- CM20 (Evaluate the relevance, limitations, and biological significance of data obtained using experimental and computational techniques.) Evaluate the relevance, limitations, and biological significance of data obtained using experimental and computational techniques.
- KM13 (Identify the fundamentals of experimental techniques in molecular genetics, genomics and proteomics, as well as the use of databases and associated bioinformatics tools.) Identify the

fundamentals of experimental techniques in molecular genetics, genomics and proteomics, as well as the use of databases and associated bioinformatics tools.

- KM15 (Identify quantitative and computational simulation methods for modelling and data analysis in population genetics and evolution.) Identify quantitative and computational simulation methods for modelling and data analysis in population genetics and evolution.
- SM16 (Apply safety, biosafety and waste management protocols in the handling and processing of biological samples.) Apply safety, biosafety and waste management protocols in the handling and processing of biological samples.
- SM17 (Use bioinformatics tools and databases for the management, analysis and simulation of genetic and genomic data.) Use bioinformatics tools and databases for the management, analysis and simulation of genetic and genomic data.
- SM18 (Interpret experimental results and genetic data to explain the basis of phenotypes and diseases, evaluating their ethical, social, and gender implications.) Interpret experimental results and genetic data to explain the basis of phenotypes and diseases, evaluating their ethical, social, and gender implications.

Contents

Module of Population Genetics

The Population genetics module is organized in 5 sessions of 2.5 hours each and they will be held in the computer room.

Practice 1-3. Simulations by computer with the program POPULUS. Study of the interaction of the main forces that modulate the evolution.

Session 1. Selection and drift.

Session 2. Selection and mutation.

Session 3. Population structure: selection and migration.

Practice 4. Molecular genetics of populations. Analysis of the nucleotide in the G6pd gene diversity

Module of Programming principles

The Module of Programming principles consists of 4 sessions of 2/3 hours each. The classes will be held in the computer room, where the theoretical contents of the Module Instrumental Techniques will be applied.

- Session 1: Programming in Python. Basic operations (3h)
- Session 2: Programming in Python. Flow control and files (3h)
- Session 3: Programming in Python. Functions and regular expressions (2h)

- Session 4: R programming language (2h)

Module of Mutagenesis

Scheduled practices in these sessions will allow the student to learn the basic techniques of:

- Practice 1: preparation of micronuclei in buccal mucosa cells
- Practice 2: DNA extraction
- Practice 3: preparation and staining observation of micronuclei
- Practice 4: Electrophoresis gels and REAL-TIME PCR
- Practice 5: Completion of questionnaires, annotation of the data and analysis of the results.

Module of Developmental Biology

The module of Developmental Biology is organized in two sessions: a first session of 2.5h at the laboratory, and a second session of 1.5h at the computer lab.

Session 1: Handling, observation of embryos and expression patterns of *Drosophila*.

Session 2: Analysis of expression patterns of *Drosophila* from databases.

Module of Scientific Documentation

The module of scientific documentation is divided in 2 sessions of 2 hours each, to be held in computerized classrooms. The contents of each session will be:

1. Bibliographic resources specialized in technical and scientific information: publishing Portals (SCOPUS, Science Direct); Web of Science. Databases in the field of medical distributor (ProQuest).

2. Bibliographic resources provided by the National Library of Medicine: Medline, Pubmed, GenBank, OMIM. Access to information about patents: Latipat and Espacenet.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Individual Tutorials	1	0.04	
Study	14	0.56	
Laboratory booknote	2	0.08	
Module Developmental Biology	6	0.24	
Module of Population Genetics	12.5	0.5	
Module Mutagenesis	17.5	0.7	
Module Scientific Documentation	4	0.16	
Module Programming principles	10	0.4	

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.

Module of Population genetics

Autonomous learning through which the student learns to work and is guided at all times by the responsible professor that establishes the objectives of the practice. Students must elaborate, interpret the results obtained and respond to the different questions raised in the practice manual.

Module Mutagenesis

The students will have a detailed script of the practices with the protocols and the detailed information to be able to carry out them efficiently with the support of the teacher. The script will be available on the Virtual Campus of the subject. The students will not only work their data, but will analyze and interpret the set of results obtained as an example of an exposed group.

Module Programming principles

Students will have an interactive practice guide (Jupyter Notebook) that they will consult to carry out the practices. To facilitate the understanding of the contents and a good development of classes it is recommended that the student read the practice guide before each session. It is also recommended to have the notes of the corresponding theory subject available.

During the session, questions and issues will be solved and at the end of each session the Jupyter Notebook will be proposed to deliver. In the end of the third practical class an integrative program must also be delivered which intends to work and integrate on all the aspects seen during the practices.

Module Developmental Biology

Students will self-manage their time following the instructions in the internship script which will explain the procedures to be performed. The teacher will supervise the students and resolve any doubts that may arise

Module Scientific Documentation

Each session will include a first part of theoretical exposition and a second of a practical type where the student will have to perform exercises related to the query of sources and the resolution of informational needs. The questions to be resolved will always be presented contextualized within the thematic field of genetics and related sciences.

Before each session, in the Campus Virtual, materials related to the contents that will be discussed in class will be published. It is advisable for the student to do a reading and a previous review in order to get the most out of the session.

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
Module Programming principles Questionnaires Continuous evaluation of the results worked	22,5%	1.8	0.072	CM18, CM19, CM20, KM13, KM15, SM16, SM17, SM18
Module of Population Genetics. Questionnaires Continued assessment of the results worked	22,5%	1.8	0.072	CM18, CM19, CM20, KM13, KM15, SM16, SM17, SM18
Module Mutagenesis Questionnaires Continuous evaluation of experimental results	22,5%	1.8	0.072	CM18, CM19, CM20, KM13, KM15, SM16, SM17, SM18
Module Developmental Biology Continuous evaluation of the results worked	22,5%	1.8	0.072	CM18, CM19, CM20, KM13, KM15, SM16, SM17, SM18
Module Scientific Documentation	10%	0.8	0.032	CM18, CM19, CM20, KM13, KM15, SM16, SM17, SM18

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

Attendance to the practices is mandatory and therefore an absence without justification may entail the non-evaluation of one or more modules. Missing a session implies a reduction of the grade equal to % of this session in the whole module. Thus, in a module of 4 sessions, missing a day involved a reduction of 25% of the note in this module. Those students who can not attend the session of their group for just cause are exempt from this penalty. Health problems are deemed justified (the corresponding medical certificate must be carried out by the practice coordinator) or serious personal problems. In this case the practice will be recovered whenever possible.

Genetic Module of Populations

This module will be evaluated by answering questions from a questionnaire after each practical session (65%) and a final exam (35%). In order to do the average over the two parts, each part must be graded ≥ 5 .

Module Mutagenesis

The module's mark will be obtained averaging an exam (70%) and a questionnaire related to practical sessions (30%). In order to make the average between the two evaluations and complete the module, each mark must be graded ≥ 5 independently.

Module of Programming principles

The module's grade will be obtained through a final exam (50%) and the exercises carried out in each session that must be delivered to the teacher together with the student's attitude in the classroom (50%). To be able to make the average between the two parts, it will be necessary to have a note ≥ 4 in each part independently.

If you do not reach the minimum mark to be able to do the average, each of the parts will be recovered independently. The part of the final test will be recovered on the scheduled date for the recovery of the subject. In the case of not having passed the exercises, the teacher will inform the procedure and deadlines.

Module Developmental Biology

This evaluation of this module will be through: (1) a short report integrating the results obtained in both sessions (80%), and (2) the student attitude and work during the practical sessions, both at the wet lab and the computer lab (20%)

Module Scientific Documentation

The evaluation system includes:

- Attendance (15%)*.
- Practical exercises (20%)*: information retrieval exercises in scientific databases
- Individual test (65%).

* Unjustified absences and failure to complete practical exercises will be penalised with 1 point.

To pass the course, it is necessary to first approve each module with a mark ≥ 5 .

Students who do not pass the different modules of the subject or wish to improve their mark can present themselves on the scheduled date for the recovery evaluation of the subject. The presentation of the student to the examination of improvement of note implies the renunciation of the qualification obtained previously. The student who has not passed one of the modules after the recovery evaluation will not approve the subject. In spite of this, it will not be necessary for a repeating student to carry out the teaching activities or the evaluations of that module passed after the second enrollment. Repeaters will only have to be evaluated for the specific module that has not been exceeded. 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.

For the written reports, the use of Artificial Intelligence (AI) technologies is permitted exclusively in support tasks, such as bibliographic or information searches, text correction or translations. The student must 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. The lack of transparency in the use of AI in this assessable activity will be considered a lack of academic honesty and may lead to a partial or total penalty in the grade of the activity, or greater sanctions in serious cases.

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 module.

This subject does not contemplate the single evaluation system.

The commission of any irregularity in an assessment act (academic fraud, plagiarism or improper use of AI, unless this use is expressly authorized in the teaching guide), which may lead to a significant variation in the grade, means that this act will be graded with a 0. In the event that the teaching guide provides that to pass the subject it is an essential requirement to have obtained a minimum grade in this assessment act or that several irregularities occur in the assessment acts of the same subject, the final grade for this subject is 0. Apart from this, a disciplinary process may be initiated against the student who incurs any of these irregularities.

Bibliography

Genetic Module of Populations

Included in the practice manual that is available to students on the virtual campus

Module Mutagenesis

The practice guide can be downloaded from the Virtual Campus

Module Programming principles

The practice guide can be downloaded from the Virtual Campus

Module Developmental Biology

The practice guide can be downloaded from the Virtual Campus

Module Scientific Documentation

ABADAL, E.; CODINA, LI. Bases de datos documentales: características, funciones y método. Madrid: Síntesis, 2005.

ADLER, David A. "Human genetics: online resources" [En línea]. Encyclopedia of life sciences, 2001. [Consulta: 12-07-2014]. Disponible a: bit.ly/1oXnTV6

ALEIXANDRE, R. "Fuentes de información en ciencias de la salud en Internet" [En línea]. Panacea@, 2011, vol. 11, núm. 33. [Consulta: 11-07-2014]. Disponible a:

<http://www.medtrad.org/panacea/IndiceGeneral/n33-Ponencias-Aleixandre.pdf>

CORDÓN, J.A, et al. Nuevas fuentes de información: información y búsqueda documental en el contexto de la web 2.0. Madrid: Pirámide, 2010.

Fuentes de información biomédica [En línea]. Cedimcat. [Consulta: 09-07-2014]. Disponible a:

<http://www.cedimcat.info/html/es/dir2471/doc26734.html>

NATIONAL HUMAN GENOME RESEARCH INSTITUTE. Online Genetics Education Resources [En línea].

National Institutes of Health. [Consulta: 11-07-2014]. Disponible a: <http://www.genome.gov/10000464>

Software

Module on Population Genetics: students will employ the software MEGA (<https://www.megasoftware.net/>).

Module Programming principles:

- Anaconda (<https://www.anaconda.com/products/distribution>), includes Python interpreter and editor Jupyter Notebook
- R-studio (<https://www.rstudio.com/products/rstudio/>)
- R (<https://cran.r-project.org/>)

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	621	Catalan	second semester	morning-mixed
(PLABs) Suport a les pràctiques de laboratori	621	Catalan	second semester	morning-mixed
(PLAB) Practical laboratories	622	Catalan	second semester	morning-mixed
(PLABs) Suport a les pràctiques de laboratori	622	Catalan	second semester	morning-mixed
(PLAB) Practical laboratories	623	Catalan	second semester	morning-mixed
(PLABs) Suport a les pràctiques de laboratori	623	Catalan	second semester	morning-mixed