

Degree programme	Type	Course
Environmental Biology	FB	1

Contact lecturer

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Group languages

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

Prerequisites

It is assumed that students have acquired the basic knowledge of Biology during high school and a revision of the baccalaureate book is recommended to those who have not studied this subject previously.

The student must have passed the laboratory safety and biosecurity test, and be knowledgeable and accept the laboratories operating regulations at the Biosciences School

Objectives

This course takes place in the first year of Environmental Biology degree and discusses the fundamental principles of Genetics starting with Mendelian Genetics and concluding with Population Genetics and Evolution. This subject has its continuity the third year with the subject of Phylogeny.

The main objective of this course is that students receive a general introduction to the basic principles of Genetics and understand the inheritance principles, their cytological and molecular basis, and the variation at the molecular and populational level.

The educational objectives are the following:

- 1) To understand the need for the study of genetics in the context of environmental Biology and the relation of genes to the environment.
- 2) To know the principles of genetic information transmission, the chromosomal theory of inheritance and be able to perform genetic maps and interpret pedigrees
- 3) To know the structure, organization, function of the genetic material
- 4) To know how to use and interpret genome databases and to understand the fundamentals of bioinformatic analysis
- 5) To know the sources of genetic variability, how measuring and interpret it from a perspective of genetic improvement, conservation and evolution.

Learning outcomes

- CM08 (Design genetics and genomics experiments adapted to different areas of biology, respecting

ethical principles and social needs.) Design genetics and genomics experiments adapted to different areas of biology, respecting ethical principles and social needs.

- KM12 (Describe the structure and organization of nucleic acids in different groups of organisms, as well as the patterns and processes of biological evolution, clearly distinguishing both concepts.) Describe the structure and organization of nucleic acids in different groups of organisms, as well as the patterns and processes of biological evolution, clearly distinguishing both concepts.
- KM13 (Define the mechanisms of inheritance and the processes that regulate gene expression, as well as the basic genetic mechanisms of evolutionary change.) Define the mechanisms of inheritance and the processes that regulate gene expression, as well as the basic genetic mechanisms of evolutionary change.
- SM11 (Use bioinformatics techniques and tools to analyse genomes and their expression products in different living organisms, interpreting the results obtained.) Use bioinformatics techniques and tools to analyse genomes and their expression products in different living organisms, interpreting the results obtained.
- SM12 (Interpret the major mechanisms of microevolution and macroevolution that have given rise to current diversity at all levels, to solve evolutionary, diversity and species conservation problems.) Interpret the major mechanisms of microevolution and macroevolution that have given rise to current diversity at all levels, to solve evolutionary, diversity and species conservation problems.

Contents

1. Introduction

Why study Genetics? Genetics and human problems. Genetics and Biology. Genes and the environment: genotype and phenotype. Genetic analysis techniques.

2. Mendelian analysis

The Mendel's experiments. Principles of segregation and independent transmission.

Mendelian genetics in humans and agriculture.

3. Determination of sex and the chromosomal theory of inheritance

Sex determination. Mitosis and meiosis. The genes are on the chromosomes. Sex chromosomes and sex linkage.

4. Extension of the Mendelian analysis

Relations of dominance. Multiple alleles. Lethal genes. Gene interaction and epistasis. Penetrance and expressivity.

5. Genetic linkage: basis of chromosomal mapping in eukaryotes

The discovery of genetic linkage: recombination. Linkage maps: calculation of recombination frequency between two points. Three point maps. Interference. The chromosomal crossover.

6. Mutation

Genetic mutations: somatic and germinals. Induction of mutations. Mutation and cancer. Mutagens in genetic analysis. Chromosomal mutations: structural and numerical.

7. Population genetics.

The Darwin Revolution. Genetic variation and its sources. The selection. Balanced polymorphisms. The adaptive landscape. Artificial selection. Randomness in populations: genetic drift and founder effect. Variation and divergence in populations. Conservation genetics.

8. Structure and DNA replication

Semiconservative replication. The mechanism of DNA replication: origin of replication.

Replication in eukaryotes.

9. DNA Function: Transcription and Translation

RNA and RNA polymerase. Initiation, elongation and termination. Introns and exons. Messenger RNA and its processing. Genetic code. Concept of codon. The transfer RNA. Degeneracy of genetic code. Protein synthesis: the ribosome. Initiation, elongation and termination.

10. Genomics

Low and high resolution physical maps. Genome sequencing strategies. Organization of DNA sequences. Sequencing of the human genome. Functional genomics. Bioinformatics.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes

Practices in computer rooms	8	0.32	SM11, SM12
Problems/Seminars	10	0.4	CM08, KM12, KM13
Lectures	30	1.2	KM12, KM13, SM12
Laboratory practices	6	0.24	KM13, SM11, SM12
Tutorials	6	0.24	KM12, KM13, SM12
Bibliographical searches	6	0.24	SM11
Study	50	2	SM11, SM12
Reading of prescribed texts	8	0.32	KM12, SM11
Problem solving	19	0.76	KM12

Lectures:

Expository sessions with TIC support. In these sessions, a relevant role is granted to the acquisition of knowledge, focusing on the acquisition of the concepts and contents of the subject. They also allow a synthesis of diverse information sources and facilitate the understanding of complex issues.

Classroom practices:

Sessions in smaller groups that allow to deepen in the master class and to work correctly each topic. In these sessions, students' skills in applying theoretical knowledge to solve practical problems are promoted, along with their participation in solving problems on the blackboard and discussing practical cases.

Laboratory practices:

Based on laboratory practices of compulsory attendance considered fundamental for Genetics as an experimental discipline. The practices consist of 4 sessions conducted in small groups to promote cooperative learning. The students will work, in the first two sessions, with living material crosses to elaborate a 3 loci genetic map. In the third session, students will work with population data on a certain character they have previously collected and then used to perform estimates of different population parameters. In the last session, students are shown the applications of bioinformatics to genetic research. This session allow them to familiarize themselves with different computer tools aimed at predicting the future of populations under given conditions.

Individual student tutorials:

One-to-one tutorials where the student has the possibility to raise specific doubts related to the topics. It is a valuable teaching complement allowing to individualize and to personalize the teaching.

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
Evaluation of problems/room activities	10% of the final grade	1	0.04	CM08, KM12, SM11, SM12

2 midterm tests	30% and 40% of the final grade respectively	5.5	0.22	KM12, KM13, SM11, SM12
Examination of laboratory practices	20%	0.5	0.02	CM08, SM11, SM12

The assessment of this subject is continuous and will include two midterm exams to assess the theory and problem contents, a questionnaire of each laboratory practice and the participation in proposed work in class, problem solving and class participation

The system of evaluation in which the specific weight of each part is considered will be as follows:

- Midterm exams corresponding to the lectures and seminars: this part will have an overall specific weight of 70%. Two qualifying written tests will be carried out with specific weights of 30% and 40% respectively.
- Laboratory practices: specific weight of 20%
- Participation in class work, problem solving and class participation: overall specific weight of 10 %

The student will pass the course if the global average grade is equal to or higher than 5 and the following minimum performance requirements are established:

- To have attended all the laboratory practices and obtained in each session a mark equal to or higher than 5. The final practice mark is the arithmetic mean of the marks obtained in each of the individual sessions
- To have obtained in each of the midterm tests a grade ≥ 5 .

The student will be able to overcome any failed midterm exam or to improve the grade through a second-chance exam at the end of the course. If the student do this exam to improve the grade, only the grade of the last exam will be valid. 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 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 conducted evaluation activities is less than 67% of the final score

Single Assessment

The single assessment consists of a single summary test in which the contents of the entire theory and exercises program of the subject will be assessed. The test will consist of questions of the same type as the continuous assessment exam. The grade obtained in this synthesis test will account for 70% of the final grade of the subject.

Attendance to laboratory practices is compulsory

In the case of deliveries and laboratory practices, the same procedure will be followed as for the continuous evaluation. The grade obtained will account for 10% and 20% of the final grade of the subject respectively.

In order to pass the subject, a final minimum grade of 5/10 in the synthesis test as well as in each of the laboratory practices is required.

The single evaluation test will be carried out coinciding with the same date set in the calendar for the last continuous evaluation test and the same recovery system will be applied as for the continuous assessment.

The use of Artificial Intelligence (AI) technologies is not permitted in this course. Any assignment containing content generated by AI will be considered a breach of academic honesty and may result in a partial or full penalty in the activity grade, or more severe sanctions in serious cases.

Academic Integrity

Any irregularity committed in an assessment activity (academic fraud, plagiarism, or improper use of AI, unless such use is expressly authorized in the study guide) that may lead to a significant alteration of the grade will result in that assessment activity being graded with a 0. If the study guide 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 engages in any of these irregularities.

Bibliography

- 1) Benito, C., F.J. Espino. Genética. (2013). Conceptos esenciales. Ed. Médica Panamericana. Online UAB library access (https://bibcercador.uab.cat/permalink/34CSUC_UAB/1eqfv2p/alma991007006939706709)
- 2) Griffiths, A.J.F., S.R. Wessler, R.C. Lewontin, S.B. Carroll. (2008). Genética. 9ª edición. McGraw-Hill/Interamericana, Madrid.
- 3) Pierce, B.A. 2016. Genética un enfoque conceptual (5ª edición). Ed. Médica Panamericana. Online UAB library access (https://bibcercador.uab.cat/permalink/34CSUC_UAB/1eqfv2p/alma991007006939706709)
- 4) Pierce, B. A. (2022). Fundamentos de genética : conceptos y relaciones. (5ª ed.). Editorial Médica Panamericana.
- 5) Pierce, B.A. 2020. Genetics: A conceptual approach (7th edition). Ed. W.H. Freeman & Company. Online UAB library access (https://bibcercador.uab.cat/permalink/34CSUC_UAB/avjcb/alma991010703420506709)
- 6) Frankham R., J.D. Ballou, D.A. Briscoe. 2010. Introduction to conservation genetics. Cambridge University press.

Exercises:

- 1) Benito, C. 1997. 360 problemas de Genética. Resueltos paso a paso. Editorial Síntesis, Madrid.
- 2) Elrod, S. & Stansfield, W.D. 2002. Schaum's Outline of Genetics. Fourth edition. Mc Graw-Hill, USA.
- 3) Jiménez, A. Problemas de Genética para un curso general. Colección manuales uex. Universidad de Extremadura, 2008.
- 4) Ménsua, J.L. 2003. Genetica. Problemas y ejercicios resueltos. Pearson Prentice Hall, Madrid.

Web links: <https://cv.uab.cat/>

Software

Populus (<https://cbs.umn.edu/populus/download-populus>)

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
(TE) Theory	21	Spanish	second semester	afternoon

(PAUL) Classroom practices	211	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	211	Catalan/Spanish	second semester	morning-mixed
(PAUL) Classroom practices	212	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	212	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	213	Catalan/Spanish	second semester	morning-mixed