Universitat Autònoma de Barcelona

2020/2021

Genetics

Code: 100853
ECTS Credits: 6

Degree	Type	Year	Semester
2500251 Environmental Biology	FB	1	2

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: spanish (spa)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: Yes

Other comments on languages

Algunas de las entregas se harán en inglés

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 and Contextualisation

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.

Competences

- Apply ICT resources pertaining to this field of study.
- Describe, analyse and interpret the vital adaptations and strategies of the principal groups of living beings.
- Identify and interpret the diversity of species in the environment.
- Identify organisms and recognise the different levels of biological organisation.
- Integrate knowledge of different organisational levels of organisms in their functioning.
- Solve problems.

Learning Outcomes

1. Apply ICT resources pertaining to this field of study.
2. Describe the principles of genetic transmission in living beings across the generations.
3. Identify the structural and functional characteristics of nucleic acids and their levels of organisation.
4. Measure and interpret genetic variation within and between populations from the perspective of evolution, conservation, and genetic improvement of animals and plants.
5. Recognise the molecular, genetic, tissue- and organism-based levels of organisation.
6. Solve problems.

Content

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 Medel'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.

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

Methodology

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.

*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			
Laboratory practices	6	0.24	1, 2, 4
Lectures	30	1.2	2, 3, 5
Practices in computer rooms	8	0.32	1, 4, 6
Problems/Seminars	10	0.4	2, 6
Type: Supervised			
Tutorials	6	0.24	3, 4, 6
Type: Autonomous			
Bibliographical searches	6	0.24	1
Problem solving	19	0.76	6
Reading of prescribed texts	8	0.32	1, 6
Study	50	2	1, 4

Assessment

The evaluation of this subject is continuous and will include two midterm exams to evaluate 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 $\geq$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

*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
2 midterm tests	30% and 40% of the final grade respectively	5.5	0.22	1, 2, 3, 4, 5, 6
Evaluation of problems/room activities	10% of the final grade	1	0.04	1, 4, 6
Examination of laboratory practices	20%	0.5	0.02	1, 4, 6

Bibliography

1) Benito, C., F.J. Espino. Genética. (2013). Conceptos esenciales. Ed. Médica Panamericana. Online library access (https://www.uab.cat/biblioteques/)

2) Griffiths, A.J.F., S.R. Wessler, R.C. Lewontin, S.B. Carroll. (2008). Genética. 9ª edició. McGraw-Hill/Interamericana, Madrid. Online library access (https://www.uab.cat/biblioteques/)

3) Pierce, B.A. 2010. Genética un enfoque conceptual (3ª edició). Ed. Médica Panamericana. Online library access (https://www.uab.cat/biblioteques/)

5) Frankham R., J.D. Ballou, D.A. Briscoe. 2010. Introduction to conservation genetics. Cambridge University press

Problemas:

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. Online library access (https://www.uab.cat/biblioteques/)

Web links:

https://e-aules.uab.cat/