

Genetics

Code: 100777
ECTS Credits: 6

Degree	Type	Year	Semester
2500250 Biology	FB	1	1

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: No

Prerequisites

There are no prerequisites to follow the course. Nonetheless, it would be desirable that students were familiar with basic knowledge of genetics, cell division, probability and statistics

Objectives and Contextualisation

The main objectives are:

- The understanding of the bases and mechanisms of biological inheritance as well as those of genetic improvement
- The ability to perform genetic analysis of the different characteristics of living organisms
- The ability to design and obtain information on genetic experiments as well as to interpret the results obtained
- The development of a historical vision that allows to summarize the main landmarks of genetics and to assess their contributions to current biology

Skills

- Analyse and interpret the origin, evolution, diversity and behaviour of living beings.
- Apply statistical and computer resources to the interpretation of data.
- Be able to analyse and synthesise
- Be able to organise and plan.
- Develop a historical vision of biology.
- Develop independent learning strategies.
- Obtain information, design experiments and interpret biological results.
- Perform genetic analyses.
- Respect diversity in ideas, people and situations
- Understand heredity mechanisms and the fundamentals of genetic improvement.
- Understand the processes that determine the functioning of living beings in each of their levels of organisation.

Learning outcomes

1. Apply statistical and computer resources to the interpretation of data.
2. Be able to analyse and synthesise.
3. Be able to organise and plan.
4. Describe and interpret the mechanisms of heredity at all levels of organisation of living beings.
5. Design experiments in genetics, and interpret the data obtained.
6. Develop independent learning strategies.
7. Explain current models on the origin of life.
8. Explain the fundamental principles of genetic improvement.
9. Perform genetic analyses of the different features of living beings.
10. Respect diversity in ideas, people and situations.
11. Summarise the basic genetic mechanisms of evolutionary change.
12. Summarise the most important historical milestones in cell biology and genetics and appreciate their contributions to present-day biology.
13. Use the bibliographic sources specific to cell biology and genetics to work independently on acquiring further knowledge.

Content

Theory

1. Introduction to Genetics. The biological inheritance. Genetics as a modern science. Basic ideas about biological inheritance.
2. Nature and organization of the hereditary material. The chromosomes. Cell division. Sexual reproduction and meiosis.
3. Genetic transmission. The works of Mendel. Segregation and dominance. Independent transmission.
4. Extensions of Mendelism. Sex and inheritance patterns. Multiple allele series. Lethality. Gene interaction. Environmental effects.
5. Mapping of eukaryotic chromosomes. Chromosomes and linkage. Recombination. Eukaryotic linkage maps.
6. Mutations. Chromosome variation. Types of chromosome mutations. Chromosomal rearrangements. Changes in chromosome number.
7. Quantitative genetics. Genetic basis of quantitative traits. Statistical analysis of the quantitative traits. Phenotypic variation and heritability. Artificial selection.
8. Population genetics. Genotypic and allelic frequencies. The law of Hardy-Weinberg. The sources of variation.

Classroom problems

1. The hereditary material
2. Monohybridism
3. Inheritance of two or more genes
4. Chromosome linkage and recombination
5. Quantitative genetics
6. Population genetics

Laboratory practices

1. Introduction to the biology and morphology of *Drosophila melanogaster*
2. Analysis of a mutant and assignment to its linkage group
3. Elaboration of a simple linkage map

Methodology

Lectures: Lectures are based on master classes with ICT support. Emphasis is made to acquisition of important concepts and skills for the students. The audiovisual material used in class can be found in the *Moodle*. The students require developing independent learning strategies outside of class.

Problems: The sessions are performed in small groups which allow to deepen the information given on the

master class and to work on specific areas of the course. These sessions promote students to apply the theoretical knowledge to solve practical problems, as well as to demonstrate their skills by solving problems on the blackboard.

Practices: These sessions are done in small groups. Here the student has the opportunity to work at the laboratory doing experiments related to practical cases of the subject. The data obtained in the experiments are analyzed and a global view of the techniques used is given. The students can access protocols and practice guides through the Moodle. To be able to attend it is necessary that the student justify having passed the biosafety and security tests (*Moodle*) and accepts the operating rules of the laboratories of the *Facultat de Biosciències*.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Laboratory practices	9	0.36	1, 4, 5, 9, 2
Lectures	30	1.2	4, 8, 7, 9, 10, 11, 12, 2, 13
Problems sessions	11	0.44	1, 5, 9, 2
Type: Supervised			
Tutorials	5	0.2	6, 10, 13
Type: Autonomous			
Individual study	68	2.72	4, 6, 8, 7, 11, 12, 13
Moodle participation	10	0.4	6, 7, 12, 13
Problems solving	10	0.4	6, 5, 9, 2

Evaluation

The evaluation of the competences is done as follows:

1 Exams. The students perform three midterm exams to evaluate the contents of theory and problems. The grade corresponding to these **three tests** represent **21%, 25% and 25%**, respectively, of the final subject grade. It is necessary to obtain a grade ≥ 3.5 in each of the midterm exams, to pass the subject. The students will be able to overcome any failed midterm exam through a second-chance exam at the end of the course. **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.** 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.

2 Practices. A test will be made for each practical session. The grade of practices is the average grade of three sessions, and represents **15%** of the final grade of the course. **Attendance at practices is mandatory.** In case of being able to justify the absence of any of the practices sessions, and not having the option of doing it in a group different from the one assigned, this session will not be considered in the calculation of the average grade of the practices. To pass the course it is necessary to attend, at least, to two practice sessions.

3 Moodle activities. This activity represents **14%** of the final grade of the course.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Exams	71	6	0.24	4, 6, 5, 8, 7, 9, 10, 11, 12, 2, 13
Moodle activities	14	0.5	0.02	6, 10, 3, 13
Practice questionnaires solving	15	0.5	0.02	1, 4, 5, 9, 2

Bibliography

Theory

- Freeman, S., K. Quillin & L. Allison (2013) **Fundamentos de Biología**. 5th edition. Pearson Educación, S.A., Madrid.
- Klug, W.S., M.R. Cummings, Ch.A. Spencer & M.A. Palladino (2013) **Conceptos de Genética**. 10th edition. Pearson Educación, S.A., Madrid.
- Griffiths, A.J.F., S.R. Wessler, R.C. Lewontin & S.B. Carroll (2008) **Genética**. 9th edition. McGraw-Hill/Interamericana, Madrid.
- Pierce, B.A. (2009) **Fundamentos de Genética. Conceptos y relaciones**. Editorial Médica Panamericana, Madrid.
- Pierce, B.A. (2016) **Genética. Un enfoque conceptual**. 5th edition. Editorial Médica Panamericana, Madrid.

Problems

- Benito, C. (1997). **360 problemas de Genética. Resueltos paso a paso**. Editorial Síntesis, Madrid
- Elrod, S. & W.D. Stansfield (2002) **Schaum's Outline of Genetics**. 4th edition. Mc Graw-Hill, USA
- Jiménez Sánchez, A. (2008) **Problemas de Genética para un curso general**. Colección manuales UEX-52. Servicio de Publicaciones, Universidad de Extremadura.
- Ménsua, J.L. (2003) **Genética. Problemas y ejercicios resueltos**. Pearson Prentice Hall, Madrid.