Universitat Autònoma de Barcelona

2018/2019

Genetics

Code: 100891
ECTS Credits: 6

Degree	Type	Year	Semester
2500252 Biochemistry	FB	2	1

Contact

Name: Amadeu Creus Capdevila
Email: Amadeu.Creus@uab.cat

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

Those inherent to the Degree. Review of statistical probabilities is advised.

Objectives and Contextualisation

The overall objective of this course is that students receive a general introduction to the basic principles of Genetics to understand the laws of heredity, its cytological and molecular basis, and its variation at the population level.

The training objectives are as follows:

1) Understand the need for the study of genetics in the context of biochemistry.

2) Know the laws of the transmission of genetic information, the chromosomal theory of inheritance, and how to make genetic maps and interpret pedigrees.

3) Know the structure, organization and function of the genetic material.

4) Know how to use and interpret genomic data.

5) Know the main sources of genetic variability in populations.

Skills

- Be able to self-evaluate.
- Collaborate with other work colleagues.
- Display knowledge of the biochemical and genetic changes that occur in many pathologies and explain the molecular mechanisms involved in these changes.
- Interpret experimental results and identify consistent and inconsistent elements.
- Manage bibliographies and interpret the information in the main biological databases, and also know how to use basic ICT tools.
- Manage information and the organisation and planning of work.
- Stay abreast of new knowledge of the structure, organisation, expression, regulation and evolution of genes in living beings.
- Take responsibility for one's own learning after receiving general instructions.

- Think in an integrated manner and approach problems from different perspectives.
- Understand the language and proposals of other specialists.
- Use ICT for communication, information searching, data processing and calculations.

Learning outcomes

1. Analyse a pedigree thoroughly and define the types of inheritance of a particular genotype and phenotype.
2. Be able to self-evaluate.
3. Calculate data related to physiological processes in animals.
4. Collaborate with other work colleagues.
5. Describe genetic alterations that can be found to underlie certain pathologies.
6. Describe the determining factors in evolution.
7. Explain the fundamental principles of genetics and reproduction.
8. Interpret experimental results and identify consistent and inconsistent elements.
9. Manage information and the organisation and planning of work.
10. Solve practical problems in genetics (including population genetics).
11. Take responsibility for one's own learning after receiving general instructions.
12. Think in an integrated manner and approach problems from different perspectives.
13. Understand the language and proposals of other specialists.
14. Use ICT for communication, information searching, data processing and calculations.

Content

Topic 1: Genetics. Fundamental concepts. Genetic analysis. Model organisms.

Topic 2: Mendelian principles: Equitable segregation and independent transmission. Type of inheritance. Mendelian inheritance.

Topic 3: Genetic consequences of mitosis and meiosis. Chromosomal theory of heredity. Biological cycles and reproduction.

Topic 4: Inheritance of sex. Determination of sex. Inheritance linked to sex. Inheritance influenced by sex. Inheritance limited to one sex. Analysis of genealogies and genetic counseling. Dose compensation mechanisms.

Topic 5: Extensions of the Mendelian analysis. Relations of dominance. Multiple allelism. Lethal genes. Genotypic interactions. Epistasis. Biochemical genetics. Penetrance and expressivity.

Topic 6: Non-Mendelian Inheritance. Cytoplasmic inheritance: mitochondria and plastids. Mobile genetic elements.

Topic 7: Linkage and recombination in eukaryotic organisms.

Topic 8: Genetic maps. Crossbreeding in two and three points. Meaning of the distance in the genetic map. Cytological demonstration of cross-over. Analysis of tetrads. Mitotic recombination. Maps in humans.

Topic 9: The double helix and the flow of genetic information. Genes in action. Fundamentals of replication, transcription and translation. The genetic code.

Topic 10: Mutation. Spontaneous mutation and induced mutation. Types of mutations. Main mutagenic agents. Repair mechanisms.

Topic 11: Numerical and structural chromosome changes. Chromatid and chromosome breaks. Deletions. Duplications. Inversions. Translocations. Variations in the number of chromosomes: euploidy and aneuploid. Aneuploidy in humans. Polyploidy: self and alopoliploids.

Topic 12: Quantitative inheritance. Traits determined by several loci. Meaning of polygenic inheritance. Selection experiments. Heritability. Partition of the variance. Measures of heritability. Quantitative inheritance in humans: the color of the skin. Studies in twins.

Topic 13: Population genetics. The Mendelian population. Gene and genotypic frequencies. Law of Hardy-Weinberg. Balance test. Not random mating. The evolutionary forces: mutation, genetic drift, migration and natural selection. The selection of quantitative characters.

Methodology

Theoretical classes (Lectures):

They are based on lectures with ICT support. In these classes a relevant role is given to the acquisition of knowledges focusing on the incorporation of the concepts and contents of the subject. They also allow a synthesis of diverse sources of information and facilitate the understanding of complex issues. Although interactivity is limited, class dynamics encourage students intervention and promote discussion.

Classes of problems and seminars:

They are sessions in smaller groups that allow to deep into the knowledge acquired from the lectures and the personal study and to work specific areas of the subject. During these sessions, the students' ability to apply theoretical knowledge to solve practical problems as well as the analysis and discussion of practical cases is promoted.

Individual tutorials:

These are personalized tutorials where the student can raise specific questions related to any content of the subject. It is a very valuable teaching complement.

Group tutorials:

In the dates prior to the exams, in agreement with the students, group tutorials can be arranged to solve general questions and doubts.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Group tutorials	3	0.12	8, 12
Lectures	30	1.2	1, 5, 6, 7, 9, 8, 12, 11
Problem classes and seminars	10	0.4	14, 3, 8, 10
Type: Supervised			
Individual tutorials	9	0.36	8, 12
Type: Autonomous			
Bibliographic search	9	0.36	14, 8, 11
Consultation of recommended books	8	0.32	9, 8, 12, 11
Problem resolution	15	0.6	1, 3, 4, 8, 12, 10

Study	62	2.48	9, 12, 10, 11, 2

Evaluation

Evaluation

The competences of this subject will be evaluated through continuous evaluation that will include 3 written tests corresponding to both theory and problems. The quality of the students' work will also be taken into account. The evaluation system considering the specific weight of each part will be as follows:

1. Assessment tests of the acquisition of contents of the subject. There will be 2 eliminatory midterm exams to evaluate the progressive understanding and acquisition of the contents (theory and problems). The set of these exams represents the 85% of the final mark. To pass the exam it is necessary to have a 5. It can be compensated with a 4.5.

2. Evaluation of the work in terms of its presentation, structure, clarity, content and synthesis capacity. This concept represents the 15% of the final mark.

3. Retake examination. It will correspond to the part or parts not previously passed. It may also serve to improve the mark.

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 weighthing of all conducted evaluation activities is less than 67% of the total final score.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Two midterm exams (First: 42.5%; second: 42.5%)	85%	4	0.16	1, 3, 5, 6, 7, 9, 8, 12, 10
Work delivery	15%	0	0	14, 3, 4, 13, 9, 12, 10, 11, 2

Bibliography

Theory:

1) Pierce, B.A. 2016. Genetics. A conceptual approach. (5th edition). Ed. Médica Panamericana.

2) Pierce, B.A. 2011. Genetic Essentials. Concepts and Connections. Ed. Médica Panamaericana.

3) Benito, C. & Espino, F.J. 2013. Genética. Conceptos esenciales. Ed. Médica Panamericana.

Problems:

1) Elrod, S.L. & Stansfield, W.D. 2010. Schaum's Outline of Genetics. Fifth edition. Mc Graw-Hill, USA.

2 Jiménez, A. 2008. Problemas de Genética para un curso general. (3rd edition). Colección Manuales UEX. University of Extremadura.

3) Ménsua, J. L. 2003. Genética. Problemas y Ejercicios resueltos. Pearson Prentice Hall, Madrid.

It is recommended to consult the teaching space of the subject.