FACULTAD DE CIENCIAS

GRADO DE BIOLOGÍA

2024/25 YEAR

GENÉTICA

Course details

Course name: GENÉTICA
Code: 100409
Degree/Master: GRADO DE BIOLOGÍA **Year:** 2
Field: GENÉTICA
Character: OBLIGATORIA **Duration:** ANUAL
ECTS Credits: 12.0 **Classroom hours:** 120
Face-to-face classroom percentage: 40.0% **Study hours:** 180
Online platform: https://moodle.uco.es/

Coordinating teacher

Name: RUIZ ROLDÁN, MARÍA DEL CARMEN
Department: GENÉTICA
Office location: Campus de Rabanales, Edificio C5 1ª planta
E-Mail: ge2rurom@uco.es **Phone:** 957218981

Brief description of the contents

The subject will deal with the fundamental principles that govern genetic inheritance including:
- Molecular basis of heredity.
- Chromosomal basis of inheritance.
- Mendelian genetic analysis.
- Extensions and modifications of Mendelism.
- Inheritance of characters with continuous variation.
- Linkage and recombination. Genetic maps.
- Gene expression.
- Regulation of gene expression.
- Mutation, repair and transposition.
- Chromosomal alterations.
- Developmental genetics, cell cycle and cancer.
- Genetic engineering.
- Population genetics.

Prerequisites

Prerequisites established in the study plan

Possess basic knowledge of Chemistry and Mathematics. Knowledge of English (reading).

Recommendations

It is recommended to have a basic knowledge of Statistics.

Study programme

1. Theory contents

Lesson 1: Basic concepts of Genetics. Genetics in the set of Biological Sciences and in today's society.

Lesson 2: Chromosomal basis of inheritance. Genes and chromosomes. Mitosis and Meiosis. Genetic significance of mitosis and meiosis.

Lesson 3: Mendelian genetic analysis. The Mendelian genetic analysis method. Principle of segregation of alleles. Principle of independent transmission. Family trees. Calculation of probabilities. Statistical verification of the segregations: Chi-square test.

Lesson 4: Heredity and sex. Sex-linked inheritance. Characteristics influenced or limited by sex. Sex determination.

Lesson 5: Extensions and modifications of Mendelism. Variations in dominance relationships. Multiple allelism. Lethal genes. Gene interaction: Epistasis. Allelism test: Complementation. Penetrance and expressivity. Interaction between genes and environment.

Lesson 6: Linkage and recombination in eukaryotes. Linkage concept. Recombination frequency and its meaning. Map distances. Genetic maps: Maps of two and three points. Interference and coincidence coefficient.

Lesson 7: Chromosomal alterations. Deletion. Duplication. Inversion. Translocation. Aneuploidy and Polyploidy.

Lesson 8: Inheritance of characters with continuous variation. Quantitative characters and continuous variation. Mendelian basis of continuous variation. Genetic and environmental component of phenotypic variance. Number of genes that control a quantitative character. Heritability. Artificial selection.

Lesson 9: Population genetics. Mendelian populations and gene pool. Allelic, genotypic and phenotypic frequencies. Hardy-Weinberg equilibrium. Inbreeding. Mechanisms of evolutionary change: Mutation, migration, natural selection, genetic drift. Speciation and evolution.

Lesson 10: Genetics of Bacteria and viruses. Genetic analysis and genetic maps in viruses and bacteria.

Lesson 11: Molecular Bases of Inheritance. Nature and structure of the genetic material. The DNA double helix and its features. Properties of nucleic acids.

Lesson 12: DNA replication. Replication enzymology. Replication in prokaryotes. Replication in eukaryotes.

Lesson 13: Organization of the genetic material. Types of genomes. Chromatin structure.

Lesson 14: Transcription and gene expression. Eukaryotic mRNA maturation.

Lesson 15: Translation and genetic code.

Lesson 16: Regulation of gene expression. Gene regulation in prokaryotes. Gene regulation in eukaryotes: Epigenetics, transcriptional and post-transcriptional control.

Lesson 17: Mutation, Repair and Transposition. DNA damage and alterations. Repair mechanisms. Types of mutations. Transposable genetic elements.
Lesson 18: Genetic and Genomic Engineering. Basic recombinant DNA techniques and their applications. Genome sequencing strategies. Functional genomics.
Lesson 19: Developmental Genetics. Development, determination and differentiation. Space-time programming of developmental gene expression. Genes that control development: study models.
Lesson 20: Cancer Genetics. Cell cycle control and programmed cell death. Tumor suppressor genes and proto-oncogenes. Other genes involved in cancer development.

2. Practical contents

1. Practical Lessons in the Laboratory:
1.1. Polymorphism analysis and Hardy-Weinberg equilibrium (2 sessions).
1.2. Repair and mutagenesis.
1.3. Application of Genetic Engineering techniques routinely used in the laboratory.

2. Practical Lessons in the classroom
Discussion and problem solving.

Bibliography

1. Bibliografía básica - Basic Bibliography
En castellano
- Pierce BA (2023) Fundamentos de Genética. Conceptos y relaciones, 5ª edn. Madrid, Panamericana.
- Pierce BA (2016) Genética: un enfoque conceptual, 5ª edn. Madrid, Panamericana.
- Klug WS, Cummings MR, Spencer CA (2013) Conceptos de genética, 10ª edn. Madrid, Pearson.
- Griffiths AJF, Wessler SR, Lewontin RC, Carroll SB (2008) Genética, 9ª edn. Madrid, McGraw-Hill.
- Benito Jiménez C, Espino Nuño FJ. (2013) Genética: conceptos esenciales. Editorial Médica Panamericana, Madrid.
- Tamarin RH (2015) Principios de genética. Barcelona, Reverté.

In English
- Pierce BA (2016) Genetics Essentials: Concepts and Connections, 3rd Edition, W.H. Freeman & Co.
- Pierce BA (2014) Genetics: a conceptual approach, 5th Edition, W.H. Freeman & Co.
- Klug WS, Cummings MR, Spencer CA (2012) Concepts of genetics, 10th Edition, Pearson.
- Klug WS (2021) Essentials of genetics, 10th Edition, Pearson.
- Griffiths AJF (2005) Introduction to genetic analysis, 8th Edition, W.H. Freeman & Co.

2. Bibliografía complementaria - Further Reading
En castellano
- Freeman S, Herron JC (2002) Análisis Evolutivo. Madrid, Pearson Educación.
- Krebs JE, Goldstein ES, Kilpatrick ST, Lewin B (2012) Genes: fundamentos, 2ª edn. Madrid, Editorial Médica Panamericana.
- Lewin B (2008) Genes IX. Madrid, McGraw-Hill Interamericana.
- Alberts B, Wilson J, Hunt T (2016) Biología molecular de la célula, 6ª edn. Barcelona, Omega.
- Lodish H (2006) Biología celular y molecular, 5ª edn. Madrid, Editorial Médica Panamericana.

- Watson JD (2016) Biología molecular del gen, 7ª edn. Madrid, Editorial Médica Panamericana.

In English

- Freeman S, Herron JC (2015) Evolutionary analysis, 5th Edition, Pearson.
- Krebs JE, Lewin B, Kilpatrick ST, Goldstein ES (2018) Genes XII, 12th Edition, Jones and Bartlett.
- Alberts B, Wilson J, Hunt T (2015) Molecular biology of the cell, 6th Edition, Garland Publishing.
- Lodish H (2008) Molecular cell biology, 6th Edition, W.H. Freeman.
- Watson JD (2015) Molecular biology of the gene, 7th Edition, The FASEB journal, Wiley Online Library.

Methodology

General clarifications on the methodology (optional)

The theoretical program will consist of lecture sessions in which the teacher will introduce the students to the contents of the subject using PowerPoint presentations.

The classes of problems will be held in medium-sized groups and will consist of the explanation of the resolution of a series of problems specific to each topic. Students must actively participate in these classes with the help of the teacher.

The laboratory practices will be developed in small groups of students using the instrumentation appropriate for its realization, so it is essential the attendance of the students to these sessions.

Methodological adaptations for part-time students and students with disabilities and special educational needs

The methodological adaptations for **part-time students** will be decided in meetings between the teaching staff and the interested students in order to personalize the possible cases that arise. In these cases, assistance will be provided to the group that best suits your needs.

In the case of **students with special educational needs**, the teacher will meet with the affected students to establish the most appropriate adaptations to each particular case, following the indications of the report issued by the Inclusive Education Unit.

Face-to-face activities

Activity	Large group	Medium group	Small group	Total
Assessment activities	6	-	-	6
Information processing activities	-	42	-	42
Practical experimentation activities	-	-	12	12
Projects based on the course contents	60	-	-	60
Total hours:	***66***	***42***	***12***	***120***

Off-site activities

Activity	Total
Exercise and problem solving activities	47
Information processing activities	93
Information search activities	40
Total hours	***180***

Results of the training and learning process

Knowledge, competencies and skills

CU2 Know and improve the user's level in the ICT field.

CB8v1 Obtain information, design experiments and interpret the results.

CB14v1 An ethical commitment to environmental and social issues.

CB17v1 Knowledge of Computer Science applied to Biology.

CB19v3 Basic concepts and procedures of Genetics.

CE5v3 The use of statistical methods in the analysis of genetic data.

CE6v2 The use of nucleic acid and protein sequence analysis software.

CE21v7 Genetic analysis and manipulation techniques (both classical and molecular).

CE49v1 Design experimental strategies to address scientific problems. The interpretation of results permitting them to explain certain biological processes under normal and pathological conditions.

Assessment methods and instruments

Intended learning outcomes	Examination	Means of practical execution	Students assignments
CB14v1	X	X	X
CB17v1	X	X	X
CB19v3	X	X	X
CB8v1	X	X	X
CE21v7	X	X	X
CE49v1	X	X	X
CE5v3	X	X	X
CE6v2	X	X	X

Intended learning outcomes	Examination	Means of practical execution	Students assignments
CU2	X	X	X
Total (100%)	***60%***	***10%***	***30%***
Minimum grade (*)	***5***	***4***	***4***

(*)Minimum mark (out of 10) needed for the assessment tool to be weighted in the course final mark. In any case, final mark must be 5,0 or higher to pass the course.

General clarifications on instruments for evaluation:

Attendance at the master classes is not mandatory but it is recommended for a better follow-up of the subject. Attendance is mandatory for problems and laboratory practices, although their fulfilment does not score in the final grade of the subject.

A **final exam** will be held in June/July that will consist of questions and problems that must be done by the students who have not obtained an average score of at least 5 out of 10 in the partial exams. There will be two **partial exams**, one in each four-month period. It will not be necessary to do the final exam if at least 4 points (out of 10) are obtained in each of them and the average between the two partial exams equals or exceeds 5 points (out of 10). If you want to do the final exam to increase the average grade in any of the partial exams, the final mark will be the obtained in the final exam. The marks of the partial exams will be maintained for the June and July calls. In no case the grades obtained in the final exams of the June or July calls will be maintained. The average grade obtained in the partial or in the final exams will constitute 60% of the final grade for the course.

The completion of **laboratory practices** is mandatory and will be scored up to a **maximum of 1 point**, based on the memories/reports delivered by the students. It will not be possible to deliver reports of practices to which has not been attended. The qualifications obtained in the laboratory practices may be maintained between courses.

The problems will be scored up to a maximum of 3 points as follows:

- a) **The response to online questionnaires**, announced in advance, will be scored up to a **maximum of 1 point**. Students in second or later enrolment will be able to maintain this qualification between courses, however, it is recommended to carry out these activities for better follow-up of the subject.
- b) **The problems solved by the student and explained in the class of problems** will be scored up to a **maximum of 2 points**. Attendance to problem classes is mandatory for first-year students. The qualifications obtained in the problem classes may be maintained between courses for students in second or later enrolment, however, it is recommended to perform this activity for better follow-up of the subject.

The qualifications obtained in practices, problems and on-line questionnaires will be added to the grade obtained in the final exam, whenever it exceeds 5 points out of 10. To pass the course it is necessary to reach at least 5 points.

Clarifications on the methodology for part-time students and students with disabilities and special educational needs:

The adaptations for the evaluation of part-time students will be decided in meetings between the teaching staff and the interested students in order to personalize the possible cases that arise.

In the case of students with special educational needs, the teacher will meet with the affected students to establish the most appropriate adaptations for each particular case, following the indications of the report issued by the Inclusive Education Unit.

Clarifications on the evaluation of the extraordinary call and extra-ordinary call for completion studies:

For the **extraordinary call and extraordinary call for completion studies** (the latter for students of second enrollment or higher), the grades obtained in the laboratory practices, on-line questionnaires and problem classes, counting for 10%, 10% and 20%, respectively, will be maintained. The exam in both calls will count for 60%.

Qualifying criteria for obtaining honors:

In accordance with the criteria of article 80 of the Academic Regulations, the mention of \"Honors\" may be awarded to students who have obtained a grade higher than 9.0.

Sustainable development goals

Good health and well-being
Quality education
Gender equality
Responsible consumption and production
Life on land

Other Faculty

Name: SÁNCHEZ LÓPEZ BERGES, MANUEL
Department: GENÉTICA
Office location: Campus de Rabanales, Edificio C5 1ª planta
E-Mail: ge2snlpm@uco.es **Phone:** 957218981

The methodological strategies and the evaluation system contemplated in this Teaching Guide will respond to the principles of equality and non-discrimination and must be adapted according to the needs presented by students with disabilities and special educational needs in the cases that are required. Students must be informed of the risks and measures that affect them, especially those that may have serious or very serious consequences (article 6 of the Safety, Health and Welfare Policy; BOUCO 23-02-23).