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COURSE GUIDE

Genetics 1: from Genes to Populations (2001124)

Grado (Bachelor's Degree)	Grado en Biología		Branch	Sciences			
Module	Genética		Subject	Genética			
Year of study	2º	Semester	1º	ECTS Credits	6	Course type	Compulsory course

PREREQUISITES AND RECOMMENDATIONS

BRIEF DESCRIPTION OF COURSE CONTENT (According to the programme's verification report)

- Molecular and chromosomal basis of heredity
- Mendelian genetic analysis
- Linkage and recombination
- Inheritance of traits with continuous variation
- Population genetics and evolution

SKILLS

GENERAL SKILLS

- CG02 - Teamwork
- CG03 - Applying knowledge to problem solving
- CG04 - Capacity for analysis and synthesis
- CG06 - Critical reasoning
- CG07 - Informatic knowledge regarding the field scope
- CG08 - Self-directed learning for continuous professional development
- CG09 - Oral and written communication in the mother tongue
- CG13 - Skills in interpersonal relations
- CG16 - Creativity
- CG17 - Information management skills
- CG19 - Ethical commitment

SUBJECT-SPECIFIC SKILLS



- CE02 - Realizar análisis genético
- CE03 - Cálculos de riesgos enfocados al asesoramiento genético
- CE08 - Realizar análisis filogenéticos
- CE14 - Manipular el material genético
- CE15 - Identificar y analizar material de origen biológico y sus anomalías
- CE43 - Knowing the types and levels of organisation
- CE44 - Conocer los mecanismos de la herencia
- CE45 - Saber los mecanismos y modelos evolutivos
- CE47 - Saber las bases genéticas de la biodiversidad
- CE54 - Entender los procesos de la replicación, transcripción, traducción y modificación del material genético

LEARNING OUTCOMES

The student will know/understand:

- The basic concepts and procedures of Genetics.
- Genetic analysis techniques (both molecular and classical).
- The mechanisms of inheritance
- Evolutionary mechanisms and models
- The genetic basis of biodiversity

The student will be able to:

- Solve genetic problems
- Develop practical skills in the methodology of the discipline.
- Design genetic experiments
- Perform risk calculations focused on genetic counseling.
- Perform phylogenetic analysis
- Manipulate genetic material
- Identify and analyze biological source material and its anomalies
- Analyze, interpret, assess, discuss and communicate data from genetic experiments
- Correctly handle the usual instrumentation in a genetics laboratory
- Apply statistical methods in the analysis of genetic data.
- Handle computer programs for the analysis of nucleic acid and protein sequences.
- Manage sources of scientific information (bibliographic databases in science).
- To critically analyze information, synthesize and communicate such information.
- Apply the acquired knowledge to the future development of professional activities in the field of Genetics.
- To value the social scope of some aspects of research in Genetics.
- To acquire a critical spirit in line with the scientific method.
- To acquire the necessary skills for self-learning.
- To work in groups
- To develop communication and public discussion skills

PLANNED LEARNING ACTIVITIES

THEORY SYLLABUS

UNIT 1. MENDELIAN GENETIC ANALYSIS. The method of Mendelian genetic analysis. Principle of segregation. Principle of independent transmission. Genealogical trees. Calculation of probabilities. Statistical testing of segregations: chi-square test.

UNIT 2. CHROMOSOMIC BASIS OF INHERITANCE. Genes and chromosomes. Mitosis and meiosis.



Genetic significance of mitosis and meiosis.

UNIT 3. EXTENSIONS AND MODIFICATIONS OF MENDELISM. Genes on sex chromosomes. Variations in dominance relationships. Multiple allelism. Lethal genes. Pleiotropy. Gene interaction and epistasis. Allelism test: complementation. Penetrance and expressivity. Sex-limited or sex-influenced traits. Gene-environment interaction. Cytoplasmic inheritance. Maternal effect.

UNIT 4. MOLECULAR BASIS OF INHERITANCE. Nature, structure and spatial organization of hereditary material. Replication of hereditary material.

UNIT 5. LINKAGE AND RECOMBINATION. GENETIC MAPS. Ligation. Recombination. Recombination frequency and its significance. Map distances. Genetic maps: two-point and three-point maps. Interference and coincidence coefficient. Somatic recombination. Molecular mechanism of homologous recombination.

UNIT 6. INHERITANCE OF TRAITS WITH CONTINUOUS VARIATION. Quantitative traits and continuous variation. Mendelian basis of continuous variation. Genetic and environmental components of phenotypic variance. Number of genes controlling a quantitative trait. Heritability. Artificial selection.

UNIT 7. POPULATION GENETICS. Mendelian populations and gene pool. Allelic and genotypic frequencies. Hardy-Weinberg equilibrium. Inbreeding. Mechanisms of evolutionary change: mutation, migration, natural selection, and genetic drift.

UNIT 8. EVOLUTIONARY GENETICS. Microevolution and macroevolution. Speciation process. Molecular evolution. Morphological evolution. Evolutionary theories.

PRACTICAL SYLLABUS

Seminars/Workshops

Papers on recent research articles in Genetics and Evolution. Search for bibliographic material on recent research in the field of Genetics and Evolution, review on this topic, elaboration of a bibliographic review paper and presentation of this paper.

Laboratory Practicals and Problems

PRACTICES 1 and 2. Solving problems of Mendelian Genetics. Seminars in which the knowledge acquired in the theoretical classes is put into practice by solving problems and practical cases of Mendelian inheritance.

PRACTICE 3. Study of mitosis. Observation and microscopic analysis of the different phases of mitosis and realization of karyotypes.

PRACTICE 4. Study of meiosis. Observation and microscopic analysis of the different phases of meiosis and discussion of their genetic significance.

PRACTICES 5 to 6. Solving problems of extensions of mendelism. Seminars in which the knowledge acquired in the theoretical classes is put into practice by solving problems and practical cases of multiple allelism, dominance relationships between alleles of a gene, lethal genes, gene interaction and epistasis, as well as the changes caused by all these phenomena in the expected proportions in genetic crosses. It is also intended that students acquire the ability to know how to use the complementation test.

PRACTICE 7. Resolution of genetic map problems, calculation of the coincidence coefficient and interference. Seminars in which the knowledge acquired in the theoretical classes is put into practice by solving problems and practical cases of genetic maps.

PRACTICE 8. Directed crosses with *Drosophila*. Carrying out crosses for the study and understanding of Mendel's laws and the analysis of the behavior of linked loci. Preparation of a report with the results.

PRACTICE 9. Solving problems of Genetics of traits with continuous variation and calculation of heritability by different procedures.

PRACTICE 10. Solving population genetics problems. Seminars in which the knowledge acquired in the theoretical classes is put into practice by solving problems and practical cases of population.



RECOMMENDED READING**ESSENTIAL READING**

- Pierce, B.A. 2020. Genetics: A Conceptual Approach. 7^a. Edition. WH Freeman Publishers.
- Pierce, B.A. 2015. Genética. Un enfoque conceptual. 5^a. Edición. Editorial Médica Panamericana.

COMPLEMENTARY READING**GENERAL COMPLEMENTARY BIBLIOGRAPHY:**

- Pierce, B.A. 2009. Genética. Un enfoque conceptual. 3^a. Edición. Editorial Médica Panamericana.
- Pierce, B.A. 2011. Fundamentos de Genética: Conceptos y relaciones. 1^a Edición. Editorial Médica Panamericana.
- Klug, W.S., M.R. Cummings, Spencer, CA & Palladino MA. 2013. Conceptos de Genética. 10^a Edición. Pearson Educación.
- Griffiths, A.J.F, S.R. Wessler, R.C. Lewontin & S.B. Carroll. 2008. Genética. 9^a Edición. McGraw-Hill/Interamericana.
- Lewin, B. 2008. Genes IX. McGraw-Hill/Interamericana.
- Brown, T.A. 2008. Genomas. Editorial Médica Panamericana.
- Benito Jiménez, C., Espino Nuño F.J. 2013. Genética: conceptos esenciales. Ed. Panamericana.

COMPLEMENTARY BIBLIOGRAPHY FOR PROBLEM SOLVING:

- Benito Jiménez, C. 1997. 360 Problemas de Genética resueltos paso a paso. Editorial Síntesis.
- Jiménez Sánchez, A. 1997. Problemas de Genética para un curso general. Universidad de Extremadura. España.
- Ménsua, J.L. 2003. Genética, problemas y ejercicios resueltos. Pearson/Prentice Hall.
- Stanfield, W.D. 1992. Teoría y Problemas de Genética. 3^a Edición. McGraw-Hill. México.
- Viseras, E. 2008. Cuestiones y problemas resueltos de Genética general (3^a Ed.). Servicio de Publicaciones de la Universidad de Granada.

RECOMMENDED LEARNING RESOURCES/TOOLS

- Library of the University of Granada: <http://www.ugr.es/~biblio/>
- Sociedad Española de Genética (SEG): <http://www.segenetica.es/>
- Online Mendelian Inheritance in Man (OMIM):
<http://www.ncbi.nlm.nih.gov/sites/entrez?db=omim>
- GeneCards: <http://www.genecards.org/>
- National Center for Biotechnology Information (NCBI): <http://www.ncbi.nlm.nih.gov>
- NCBI Database: <https://www.ncbi.nlm.nih.gov/search/>
- PubMed: <http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=PubMed>
- Medline: <https://medlineplus.gov/>
- National Center for Biotechnology (CNB): <https://www.cnb.csic.es/index.php/es/>
- European Bioinformatics Institute (EBI): <http://www.ebi.ac.uk>
- The Institute for Genome Research: <http://www.jcvi.org/>
- Science On-Line: <http://www.sciencemag.org>
- Nature On-Line: <http://www.nature.com>
- DNA Learning Center: <https://www.dnalc.org/>
- Khan Academy: <https://es.khanacademy.org/>

TEACHING METHODS

- MD01 - Lección magistral/expositiva
- MD02 - Sesiones de discusión y debate
- MD03 - Resolución de problemas y estudio de casos prácticos
- MD04 - Prácticas de laboratorio y/o clínicas y/o talleres de habilidades
- MD06 - Prácticas en sala de informática
- MD07 - Seminarios
- MD08 - Ejercicios de simulación
- MD09 - Análisis de fuentes y documentos
- MD10 - Realización de trabajos en grupo
- MD11 - Realización de trabajos individuales

ASSESSMENT METHODS (Instruments, criteria and percentages)

ORDINARY EXAMINATION DIET

Continuous evaluation. The assessment of the level of acquisition by the students of the general and specific competences will be carried out continuously throughout the academic period by means of the following procedures:

- Theoretical knowledge exam where both the assimilation and the expression of the acquired knowledge will be evaluated. 50% of the final grade.
- Examination of problem solving and laboratory practices. 30% of the final grade.
- Performance of tutored work (Seminars). 10% of the final grade.
- Performance of activities where the tasks that the students will perform throughout the course, both individually and in groups, will be evaluated. 10% of the final grade.

Ordinary call in January

Students must obtain a minimum of 50 points out of 100, being mandatory to obtain a minimum of 25 points out of 50 in the theoretical exam and a minimum of 15 points out of 30 in the practical exam.

EXTRAORDINARY EXAMINATION DIET

February Extraordinary Examination

Those students who do not obtain the 50 points will have to take the extraordinary exam in February. The exam will be composed of theory questions (proposed syllabus; 60% of the grade) and practical sessions (syllabus corresponding to the laboratory practices and problems; 40% of the grade). As in the January exam, the course will be passed by obtaining a minimum of 50 points out of 100 in the final grade and it is mandatory to obtain a minimum of 30 points out of 60 in the theory exam and a minimum of 20 points out of 40 in the practical exam.

SINGLE FINAL ASSESSMENT (evaluación única final)

A single exam will be given to those students who, by means of a request to the Department Direction, duly justify the reasons why they cannot follow the continuous evaluation, and always, complying with the evaluation regulations of the UGR. The exam will be composed of theory questions (proposed syllabus; 60% of the grade) and practical questions (syllabus corresponding to laboratory practices and problems; 40% of the grade). Students must obtain a minimum of 30 points out of 60 in the theory exam and a minimum of 20 points out of 40 in the practical exam both in January and February.





ADDITIONAL INFORMATION

Subject coordinator: Roberto de la Herrán Moreno rherran@ugr.es
PRADO Platform: <https://prado.ugr.es/>

