Universidad Zaragoza

Academic Year/course: 2024/25

28410 - Genetics

Syllabus Information

Academic year: 2024/25
Subject: 28410 - Genetics
Faculty / School: 105 - Facultad de Veterinaria
Degree: 451 - Degree in Veterinary Science
ECTS: 6.0
Year: 2
Semester: First semester
Subject type: Basic Education
Module:

1. General information

Genetics studies heredity and the processes that determine the characteristics of a species and intraspecific variation.

Objectives: to know the genetic basis of intergenerational transmission of traits (molecular, cellular, individual and population levels) and of animal pathologies and to integrate genetic principles with other subjects.

These approaches and objectives are aligned with the Sustainable Development Goals (SDGs; United Nations Agenda 2030 ;https://www.un.org/sustainabledevelopment/es/) and certain specific targets ;the acquisition of the subject learning results will contribute to some extent to the achievement of objectives 3.9, 4.7, 5.5, 8.8, 9.c, 15.5 and 16.10.

Pre-requirements: competencies in Biology and Biochemistry, Epidemiology and Biostatistics and Basic Sciences for Veterinary Medicine.

Safety recommendations :

https://veterinaria.unizar.es/estudiantes/formacion-prevencion-riesgos-y-seguridad#normas

https://veterinaria.unizar.es/prevencion/protocolosespecificosveteriaria

http://patologiaanimal.unizar.es/medidas-de-seguridad

2. Learning results

1. To know the genetic molecular basis of biological processes: nature, organization and replication of hereditary material, genetic information and expression in cells, differentiation and development, mutation and repair of hereditary material, population dynamics.

2. To describe and interpret the principles of transmission and recombination of genetic information through generations in both prokaryotes and eukaryotes.

3. To be able to give genetic counselling by guiding in the interpretation of data in cases of genetic problems.

4. To identify and know the basic principles of genetic biotechnology and the processes of genetic modification in different organisms.

5. To handle basic laboratory material and techniques: To recognize with macroscopic and microscopic methods and imaging techniques, both the results of gene expression and the structural results of the genetic material (chromosomes and DNA) and be able to perform protocols for purification, amplification and sequencing of genomic DNA from biological sources.

6. To use the necessary computer tools to carry out the genetic analysis.

3. Syllabus

Program of theoretical classes:

- BLOCK 1. STRUCTURE AND ORGANIZATION OF HEREDITARY MATERIAL (1 week)

  Topic 1. Nature of the hereditary material.

  Topic 2. Replication.

  GENETICS OF TRANSMISSION (2 weeks)

  Topic 3. Chromosomal theory of inheritance

  Mendelism as a genetic consequence of meiosis and fertilization.

Topic 5. Complex Mendelism. Applications in the detection and diagnosis of pathologies of genetic origin in livestock species.

Topic 6. Inheritance and sex. Applications in the detection and diagnosis of pathologies of genetic origin in livestock species.

- BLOCK 2. BONDING AND RECOMBINATION (1 + 1/2 week)

Topic 7. DNA recombination.

Topic 8. Gene linkage analysis in eukaryotes. Recombination frequencies. Double recombination. Complete ligation.

Recombination in prokaryotes. In-depth gene structure.

GENOME KNOWLEDGE (1 week)

Drawing of genetic maps and physical maps in animal species of interest in veterinary medicine.

Gene maps in prokaryotes. Bacterial and viral mechanisms that enable genetic mapping.

- BLOCK 3. CHANGES IN HEREDITARY MATERIAL (3 weeks)

Topic 12. Chromosomal mutations: Structural variations in chromosomes.

Topic 13. Chromosomal mutations: Numerical variations in chromosomes

Topic 14. Chromosomal abnormalities in domestic animals and their consequences in animal production and reproduction.

Topic 15. Gene mutations. Applications in the detection and diagnosis of pathologies of genetic origin in livestock species.

Topic 16.- Mitochondrial DNA.

REPAIR OF INHERITED MATERIAL (1/2 week)

Topic 17.-DNA repair

- BLOCK 4. CONTROL AND REGULATION OF GENE EXPRESSION (1 week)

Mechanism of transcription. RNA maturation.

Topic 19.- Translation, protein synthesis and genetic code.

DEVELOPMENTAL GENETICS (1/2 week)

Topic20.-Developmental genetics.

- BLOCK 5.- GENETIC BIOTECHNOLOGY (1 + 1/2 week)

Recombinant DNA technology

DNA analysis. Applications in the production, reproduction and improvement of livestock species

- BLOCK 6. POPULATION GENETICS (3 weeks)

Topic 23. Basic concepts of population genetics. Characterization of populations.

Item 24. Disturbances of Hardy-Weinberg equilibrium I: Systematic processes.

Item 25. Disturbances of Hardy-Weinberg equilibrium II: Dispersive processes.

Practice program:

Practice 1. Cytological basis of inheritance, observation and identification of cell cycle phases.

Practice 2. DNA extraction.

Practice 3. Sex diagnosis by DNA test in animal species.

Practice 4. Study of chromosomal anomalies in livestock species. Karyotypes.

Practice 5. “In vitro" cell cultures.

Practice 6. Mutagenesis. Detection of DNA modifications.

Practice 7. Restriction maps. Cloning and subcloning of DNA sequences, using different computer programs.

Practice 8. Study of genetic variability using electrophoretic techniques. Estimation of genotypic and allelic frequencies. Hardy-Weinberg equilibrium in the population.

Program of problem classes

1. Monohybridism. Crosses between lines that differ in only one character. Dominant and non-dominant genes.
2. Complex Mendelism. Lethal genes.
3. Analysis of genealogies.
4. Sex-linked inheritance.
5. Genetic linkage and recombination.
6. Linked genes and gene maps in eukaryotes.
7. Gene maps in prokaryotes.
8. Structural chromosomal abnormalities.
9. Variation in the number of chromosomes.
10. Genetic constitution of a population and Hardy-Weinberg equilibrium
11. Change of gene frequencies I.
12. Change of gene frequencies II.

4. Academic activities

1 Participatory Master Class: 30h

Graphic material available at the ADD (Anillo Digital Docente). Participation of the students in the discussion of doubts and relevant or difficult aspects.

2. Laboratory Practices and Computer Classroom: 18 h

Experiments of genetic analysis in groups . Elaboration of the practice notebook (methodological summary and questionnaire).

3. Problem solving and case studies.

a) Classroom problems: 12 h

Resolution of typical problems.

b) Problems delivered to the practice groups:

The practice groups receive a booklet with problems to be solved as a group. Each student publicly solves the problem required by the teachers (12 groups; 2 hours/group).

5. Assessment system

(1) Written exam (70% of the final grade of the subject): It assesses learning results 1, 2 and 4.

Both exams consist of a test (30% of the written exam grade), questions (30%) and problems (40%). The test shows four alternatives/question, with only one correct; errors are graded with -0.33 points. The grade for each part ranges from 0 to 10.

(2) Oral and public problem solving (15% of the final grade). It assesses learning results 1 and 3. This grade will be not kept in case of absence or unsatisfactory explanation of the problem.

(3) Practical written exam (15% of the final grade). It assesses learning results 5 and 6.

Coincident with (1) in both calls. In the case of unexcused absences, the grade of this exam will be multiplied by the proportion of practice sessions taken.

Final grades: Sum of the partial grades, if at least a 5 out of 10 is obtained in the written exam.

Grades (2) and (3) will be maintained in successive calls up to a maximum of 5 academic years. If the student wishes to improve them, they must join a group in the new academic year.

For non-face-to-face students, a single written exam with the characteristics of (1) is foreseen.

6. Sustainable Development Goals

3 - Good Health & Well-Being
4 - Quality Education
5 - Gender Equality