Universidad Zaragoza

Year : 2019/20

28410 - Genetics

Syllabus Information

Academic Year: 2019/20
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

1.1.Aims of the course

The subject and its expected results respond to the following approaches and objectives:

Genetics studies heredity and the processes that lead species to be as it is and to variation within each species, since genes are the determinants of the inherent properties of each living organism.

The knowledge of Genetics is essential for the complete understanding of other disciplines in Veterinary Science: Anatomy, Biochemistry, Cytology, Microbiology, Pathology, Reproduction..... because the study of Genetics is carried out at molecular, cellular, organism, family, population and evolutionary levels.

The aims of this course are to:

- Know the fundamentals of Genetics and to know how to use the basic terminology related to genetic material.
- Know the principles that govern the inheritance of characters between generations.
- study the molecular bases of the structure, function and regulation of genes.
- Understand the causes of the genetic variation of living beings.
- Handle simple models of genetic analysis in the laboratory.
- Analyzing biological sequences by computer methods.
- Understand the fundamentals of constructing genetic maps and physical maps.
- Understand the basic mechanisms of genetic evolution.
- Know the characteristics that provide genetic balance in a population
- Analyze the factors that change the genetic structure of populations.
- Understand the genetic basis of the pathology of species of veterinary interest.
- Integrate the principles of genetics with the rest of the veterinary matters

1.2.Context and importance of this course in the degree

This course prepares students to know the bases of heredity and the processes that imply the transmission of hereditary traits, the bases of animal identification, the genetic support involved in reproduction, production and many of the pathologies presented by species of veterinary interest. And in short, the application of all this knowledge to your professional task as a veterinarian.

1.3.Recommendations to take this course

In order to take this subject, it will be required to have acquired the competences of the first and second four-month term subjects of the Veterinary Degree, exclusively those referring to Biology and Biochemistry, Epidemiology and Biostatistics and Basic Sciences for Veterinary Medicine.

2.Learning goals

2.1.Competences

After completing the course, the student will be competent in the following skills:

Generic transversal competences

- Ability to organize and plan
- Oral and written communication
- Elementary computer skills
- Skills for working in a group
- Skills to retrieve and analyze information from different sources
- Dexterity in the handling and interrelation of genetic concepts.
- Ability to interpret genetic facts or data
- Ability to propose and assess hypotheses

Specific competences

- Know the molecular and genetic bases of biological processes To know the nature, organization and replication of hereditary material
- Know the processes of cell differentiation, division and proliferation, information and genetic expression in cells. Know the principles of control and regulation of gene expression
- Describe and interpret changes in genetic material
- Identify and know the repair capacity of the hereditary material.
- Know the basic mechanisms that allow detecting and diagnosing genetic diseases in the main veterinary species.
- Interpret population dynamics from a genetic basis. Apply genetic concepts to real experimental situations.
- Handle the basic material and techniques of a genetics laboratory, including
- Acknowledge protocols for the purification, amplification and sequencing of genomic DNA from biological sources and the use of computer tools for genetic analysis.

2.2.Learning goals

If students complete the course successfully, they should be able to

1. Know the genetic bases of biological processes: nature, organization and replication of hereditary material, information and genetic expression in cells, differentiation and development, mutation and repair of hereditary material, population dynamics.
2. Describe and interprets the principles of transmission and recombination of **genetic** information across generations in both prokaryotes and eukaryotes.
3. Give genetic advice guiding in the interpretation of data in cases of genetic problems.
4. Identify and know the basic principles of genetic biotechnology and the processes of **genetic** modification in different organisms.
5. Manage the material and basic laboratory techniques: Recognizes with macroscopic methods, microscopic and imaging techniques, both the results of gene expression and the structural genetic material (chromosomes and DNA). It is capable of performing protocols for purification, amplification and sequencing of genomic DNA from biological sources.
6. Use the necessary computer tools to carry out the genetic analysis.

2.3.Importance of learning goals

The student who has passed the course will be able to analyze the main mechanisms of inheritance in species of veterinary interest and the processes that originate the manipulation, selection and reproduction of hereditary traits. You can determine how inheritance is passed from one generation to the next, and how the characteristics that control these transmission processes are developed.

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

The student must demonstrate that achieved the intended learning outcomes through the following assessment activities:

1. **Written exams**

An exam at the end of the term. It will take place according to a schedule approved by the Center Board. It will consist of three parts: multiple-choice questions, short answer questions and problems. The score for multiple-choice questions is 30%, the score for short questions is 30% and the score for problems is the remaining 40% of the exam grade. Test errors will not be scored with negative points.

The grade for this written exam will be 60% of the final grade.

Written examinations assess learning outcomes 1, 2 and 4.

1. **Oral Problem Solving Session**

The correct resolution in public of the oral test of problems and the booklet with the solved problems, will suppose a 15% of the final grade. The absence or unsatisfactory explanation of a problem will mean the loss of the points. The mark obtained in this section will be saved for successive courses (with a maximum of 5 years) and if the student wishes to improve it, she/he will be allowed to join a group in the chosen course.

This test evaluates learning outcomes 1 and 3.

1. **Seminar sessions and group work**

Both the level of the presentation and the presentation (clarity, ability to communicate and discuss the results, etc.) will be scored. It will be graded with 15 % of the final grade. The mark obtained in this section will be saved for successive courses (with a maximum of 5 years) and if the student wishes to improve it, he will be allowed to join a group in the chosen course.

This test evaluates learning outcomes 2, 3 and 4.

1. **Laboratory sessions and Computer Rooms**

These sessions and examination will be graded with 10 % of the final mark. The mark obtained in this section will be saved for successive courses (with a maximum of 5 years) and if the student wishes to improve it, she/he will be allowed to join a group in the chosen course.

The practice exam will be written and will be carried out at the same time and in the same place as the end of term written exam, annexed to it.

This test evaluates learning outcomes 5 and 6. Final score

The final score will be the sum of all partial grades, provided the student obtains at least a 4 out of 10 written test score.

The scores obtained during the course in the activities described in sections (2), (3) and (4) will be maintained in the 2nd session of the same course for those students who have not passed the subject in the 1st session, in addition to the fact that the mark obtained in sections 2, 3 and 4 will be saved for successive courses (with a maximum of 5 years). In the event that the student wishes to improve it, he/she will be allowed to join a group in the chosen course.

Marking system:

According to the national regulation Law 1025/2003, 5th of September which lays down the European system of credits and marking system for the university degree.

0-4,9: FAIL.

5,0-6,9: PASS

7,0-8,9: GOOD (NT).

9,0-10: EXCELLENT (SB).

As the article 158 of the Statutes of the University of Zaragoza lays down, provisional grades will be displayed at least for 7 days and students will be able to review them on the date, time and place provided for that purpose.

Tests for students who are not present or those who present themselves in other session but first.

A final exam that will include:

Theory exam: A test (graded 30% of the final grade) and short questions, graded another 30% of the final grade.

Examination of Problems: will be graded with 40 %.

Errors in the test will not be graded with negatives and the final grade will be the sum of the grades of each test performed. These tests are used to assess learning outcomes 1 to 6.

Learning process designed for this subject is based on:

The theoretical knowledge of principal concepts of Genetics, but also on their practical applications to livestock species. Planned practice are intended to put in touch with reality by means of observation and direct handling of genetic material, both in laboratory and in field.

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The learning process designed for this subject is based on the theoretical knowledge of principal concepts of Genetics, but also on their practical applications to livestock species. Planned practice are intended to put in touch with reality by means of observation and direct handling of genetic material, both in laboratory and on field

4.2.Learning tasks

1. **Theoretical sessions.**

Attendance hours: 30.

Non-attendance hours: 45.

Teaching and learning methodology:

Lectures are complemented by graphics and schemes from PowerPoint presentations and development of ideas on the blackboard. Previously, graphic material is at the disposal of the students from both ADD and Copying Service of the Faculty. Students questions and discussions about genetic subjects are encouraged.

1. **Laboratory sessions.**

Attendance hours: 16.

Non-attendance hours: 0.

Teaching and learning methodology: Practical activities consist of conducting an experiment about genetic analysis during eight two-hour sessions in the student laboratory of the Area of Genetics and in the Computer classroom. Each student will elaborate a laboratory booklet about session's methodology and answer to teacher's questions.

1. **Problems sessions.**

1. Classroom sessions the two groups of students.

Attendance hours: 12.

Non-attendance hours: 18.

Teaching and learning methodology:

Problems relative to subjects exposed during theoretical sessions (one hour/week). Collections of problems are at the disposal of the students from both ADD and Copying Service of the Faculty. The teacher solves several problems, as examples for improving student's comprehension of genetic subjects.

1. Problems for the students' teamwork.

Non-presential hours: 13.

Teaching and learning methodology:

Problems different to those solved in classroom are given in advance to students' teamworks. At the end of course, every student in these teamwork will participate in a public session for the presentation, discussion and resolution of the problems, where all teachers involved in problems sessions will be present.

1. **Seminars.**

Attendance hours: 2.

Non-attendance hours: 10.

Teaching and learning methodology:

Public presentation of works elaborated by students' teamwork. Complementary activity for dealing with subjects not taught previously.

Table summary of teaching-learning activities

ACTIVITY	PRESENTIAL HOURS	FACTOR	NON-PRESENTIAL HOURS *	TOTAL
Theoretical sessions	**30**	**1.5**	**45**	**75**
Problems sessions in classroom	**12**	**1,5**	**18**	**30**
Laboratory and computer sessions	**16**	**-**	**-**	**16**
Seminars	**2**	**5.0**	**10**	**12**
Evaluations	**-**	**-**	**4**	**4**
Problems for the students' teamwork	**-**		**13**	**13**
Total	**60**	**1.5**	**90**	**150**

According to regulations of the Universidad de Zaragoza

Summary of hours of student dedication for each activity

Activity	Hours

Presential (Theoretical , problems and laboratory sessions, seminars)	**60**
Authorized non-presential (Evaluations)	**4**
Non-presential (personal study, bibliographic consultation)	**86**

Total: 150 hrs

4.3.Syllabus

Theoretical sessions

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

Topic 1. Nature of the hereditary material.

Topic 2. Replication.

GENETIC TRANSMISSION (2 weeks).

Topic 3. Chromosome theory of inheritance.

Topic 4. The mendelism as a genetic consequence of meiosis and fertilization.

Topic 5. Complex mendelism. Applications in the detection and diagnosis of diseases of genetic origin in livestock species.

Topic 6. Inheritance and Sex. Applications in the detection and diagnosis of diseases of genetic origin in livestock species.

BLOCK 2. **LINKAGE AND RECOMBINATION** (1+ 1/2 weeks).

Theme 7. DNA recombination.

Theme 8. Linkage analysis of eukaryote genes. Double recombination. Complete linkage. Theme 9. Recombination in prokaryotes. Gene structure.

KNOWLEDGE OF THE GENOME (1 week).

Theme 10. Making genetic and physic maps of livestock species.

Theme 11. Gene maps in prokaryotes. Bacterial and viral mechanisms that allow the development of gene maps.

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

Theme 12. Chromosome mutations. Structural variations of chromosomes.

Theme 13. Chromosome mutations. Numerical variations of chromosomes.

Theme 14. Chromosome abnormalities in livestock species and consequences on animal production and breeding.

Theme 15. Gene mutations. Applications in the detection and diagnosis of diseases of genetic origin in livestock species.

Theme 16. Mitochondrial DNA.

REPAIR OF HEREDITARY MATERIAL (1/2 week).

Theme 17. DNA repair.

BLOCK 4. **REGULATION AND CONTROL OF GENE EXPRESSION** (3 weeks).

Theme 18. Transcription. RNA maturation.

Theme 19. Translation, protein synthesis and gene code.

DEVELOPMENTAL GENETICS (1/2 week).

Theme 20. Development genetics.

BLOCK 5. **GENE BIOTECHNOLOGY** (1 + 1/2 weeks).

Theme 21. Recombinant DNA technology.

Theme 22. DNA analysis. Applications to animal production, improvement and breeding.

BLOCK 6. **POPULATION GENETICS** (3 weeks).

Theme 23. Basic concepts about population genetics. Characterization of populations.

Theme 24. Deviation from Hardy-Weinberg equilibrium I: systematic factors.

Theme 25. Deviation from Hardy-Weinberg equilibrium II: dispersive force.

Laboratory sessions program:

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

Session 2. DNA extraction.

Session 3. Sex diagnosis by DNA testing in livestock species.

Session 4. Chromosome abnormalities in livestock species. Karyotipes.

Session 5. Cell culture.

Session 6. Mutagenesis. Detecting DNA modifications.

Session 7. Restriction maps. Cloning and subcloning of DNA sequences by using several softwares.

Session 8. Study of gene variation by electrophoretic techniques. Estimation of genotype and allele frequencies. Hardy-Weinberg equilibrium in a population.

Basic security rules for laboratory sessions:

- Mandatory use of the robe.
- Use in various sessions of splash-proof safety goggles.
- In sessions that require safety glasses, optical contact lenses may not be used.
- Except for very short hair, it is necessary to use a cap or a system that collects and holds the hair.
- Any other safety requirement that teachers consider necessary in particular sessions.

Problem sessions program:

1. Monohybridism. Crosses between lines differing in a single character. Dominant and non-dominant genes.
2. Complex mendelism. Lethal genes.
3. Analysis of genealogies.
4. Sex-linked inheritance.
5. Linkage and recombination.
6. Linked genes and gene maps in eukaryotes.
7. Gene maps in prokaryotes.
8. Structural chromosome abnormalities.
9. Variations of chromosome number.
10. Gene characteristics of populations and Hardy-Weinberg equilibrium.
11. Changes in allele frequencies I.
12. Changes in allele frequencies II.

4.4.Course planning and calendar

Dates and key milestones of the subject are described in detail, along with the rest of the subjects of the second course in the degree of veterinary medicine, on the website of the Facultad de Veterinaria (link: http://veterinaria.unizar.es/gradoveterinaria/). This link will be updated at the beginning of each academic year.

4.5.Bibliography and recommended resources

http://psfunizar7.unizar.es/br13/egAsignaturas.php?codigo=28410