GENETICS (2015-16)

GENERAL INFORMATION

Code 26513

ECTS Credits 6

Departments and areas

Department	Area	Area	Report R.
PHYSIOLOGY, GENETICS AND MICROBIOLOGY	GENETICS	YES	YES

Studies

DEGREE IN MARINE SCIENCES

DEGREE IN BIOLOGY

Context of subject

Genetics as central subject in the study of Biology has unified all biological sciences by revealing the uniformity of hereditary systems.

Genetics explains the processes of biological evolution as a change in allele frequencies, since genetic diversity is one of the basic levels of biodiversity. The understanding of the genetic dynamics of the populations is fundamental for theirs study and conservation. Gene-environment interactions (nature/nurture) explain the forms and characteristics of living organisms.

In addition, Genetics has a remarkable influence in our society:

- Modern society depends on Genetics, through the improvement of crop plants and farm animals.

- Genetics is of great importance in medicine, since a good number of diseases have a genetic basis

- Genetics affects the vision that we have of the world, our relations with the organic world and the rest of the universe.

OBJECTIVES

Subject objectives/competences (2015-16)

Subject objectives/competences

To understand the basic mechanisms of inheritance, genetic variability, biodiversity and evolution.

To construct and interpret chromosome maps.

To apply the scientific method in the context of Genetics.

SPECIFIC OBJECTIVES

To learn how to solve problems of Genetics.

To get familiar with techniques for genetic analysis as well as the application of statistical methods in the analysis of genetic information

To learn the correct use of a set of instruments in the Genetics laboratory

To be able to analyse and value the information obtained from genetic experiments

To know and assess the social scope of some aspects of research in Genetics.

To develop abilities concerning experimental design, hypothesis testing, scientific criticism, and other skills related with the scientific method in general, and genetic analysis in particular

To develop general skills, such as oral and written communication, innovation, steadiness, public speaking and discussion.

CONTENTS

Theoretical and practical contents (2015-16)

0. **COURSE PRESENTATION** (1 h.)

1. **INTRODUCTION TO GENETICS** (1 h.)

1.1. Genetics in Biology and society

2. **GENERAL ASPECTS OF HEREDITY** (10 h.)

2.1. Mendel and the basic principles of inheritance

2.1.1. Patterns of single-gene inheritance (1 h.)

2.1.2. Independent transmission of genes. (1 h.)

2.2. The chromosomal basis of inheritance

2.2.1. Prokaryotic and eukaryotic chromosomes (1 h.)

2.2.2. Cell division: mitosis and meiosis (1 h.)

2.2.3. Sex determination and sex-linked inheritance. Cytoplasmic inheritance. (1 h.)

2.3. Modes of inheritance in pedigrees. Genetic basis of human pathologies. (1 h.)

2.4. Gene interactions and gene-environment interactions

2.4.1. Interactions between alleles of the same gene. Dominance variations. Multiple and lethal alleles. (1 h.)

2.4.2. Interactions between alleles of different genes. Epistasis. (1 h.)

2.4.3. Determination of metabolic pathways and complementation assay. (1 h.)

2.4.4. Penetrance and expressivity. Environmental effects. (1 h.)

3. **GENETIC MAPPING** (5 h.)

3.1. Chromosome mapping in eukaryotes

3.1.1. Linkage detection. Recombination frequency and its use in mapping (1 h.)

3.1.2. Chormosome mapping in haploid eukaryotes (1h)

3.1.2. Mapping with molecular markers. Physical maps. (1 h.)

3.2. Chromosome mapping in prokaryotes and viruses

3.2.1. Bacterial conjugation. Transformation. Transduction. (1 h.)

3.2.2. Genetics of bacteriophages and other viruses (1 h.)

4.1. **POPULATION GENETICS**. (3 h.)

4.1.1. Genetic structure of populations.

4.1.1.1 Variation in natural populations.

4.1.1.2. Genotype and allele frequencies.

4.1.2. The Hardy-Weinberg equilibrium model (1 h.)

4.2. Evolutionary genetics

4.2.1. Evolutionary forces.

4.2.1.1. Mutation and migration. (1 h.)

4.2.1.2. Natural selection and genetic drift (1 h.)

4.2.2. Speciation and evolution. (1 h.)

4.2.2.1 Mechanisms of speciation and reproductive isolation mechanisms

4.2.2.2. Selectionism and neutralism.

5. **THE GENERATION OF GENETIC VARIATION** (6 h.)

5.1. The molecular nature of the gene

5.1.1. The concept of gene. (1 h.)

5.2. Gene expression. (1 h.)

5.2.1. Transcription.

5.2.2. Translation. The genetic code. (1h)

5.3. Gene mutations. (1 h.)

5.3.1. Types and origin of mutations.

5.3.2. Phenotypic effects of mutations.

5.4. Chromosome mutations.

5.4.1. Variation in chromosome structure. (1 h.)

5.4.2. Variation in chromosome number. (1 h.)

5.4.3. Chromosome mutations and evolution.

PRACTICAL CONTENTS

- **Practical 1.** Pea plant Genetics. Mendel's Laws. Computer practice. 2 h.
- **Practical 2**. Phenotypic segregation analysis in maize. Lab practice. 3 h.
- **Practical 3**. Drosophila melanogaster..Monohybrid and dihybrid crosses. Linkage and recombination maps. Lab practice. 3 h.
- **Practical 4**. Genetics of ascospore color in Sordaria. Lad. practice. 3h
- **Practical 5**. Genetics of PTC tasting in humans. Lab practice. 3 h.
- **Practical 6**. Population genetics and evolution. Computer practice. 2 h.

Practical 7. Human Karyotypes. Lab practice. 3h

- **Problems discussion Practice**. Students will discuss the solutions to representative problems related to topics addressed in theoretical lectures. 10 h.
- **Group tutorials**. Problem solving activities by using a provided learning guide. 3 h.

EVALUATION

Instruments and criteria of Evaluation 2015-16

A total of 50 points could be obtained from "group problems" (answers to problems followed by class discussion, up to 2 points each problem) and another 50 points from 2 Exams, each one containing both test and problem(s) at 50%.

To pass the course, a total of 50 points with a minimum of 20 from the Exams is required. Each of the 2 exams will consist of problems and test questions at 50%.

Type	Criterion	Description	Ponderation
FINAL TEST	Theoretical and practical test.	Final test	50
ACTIVITIES OF EVALUATION DURING THE SEMESTER	Group tutorials: Attitude and preparation in group tutorials Presentation of a learning guide based on problem resolution, with several problems and practical cases that will be solved in group.	Teacher remarks	5
ACTIVITIES OF EVALUATION DURING THE SEMESTER	**Lab and computer practicals. Attendance, active participation and questions and/or reports.**	Lab and computer practicals	30
ACTIVITIES OF EVALUATION DURING THE SEMESTER	Practice problems: Handing in the solved problems and oral presentation. Problems will be presented to the students at least two weeks before Discussion Sessions, where students must hand in the solutions and to orally defend the proposed solution. The assessment implies the attendance, correct resolution of the problems and the oral comprehensive explanation.	Practice problems with oral presentations	15