# 27105 - Genetics

**Información del Plan Docente**

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| **Academic Year** | 2018/19 |
| **Subject** | 27105 - Genetics |
| **Faculty / School** | 100 - Facultad de Ciencias |
| **Degree** | 446 - Degree in Biotechnology |
| **ECTS** | 6.0 |
| **Year** | 1 |
| **Semester** | Second semester |
| **Subject Type** | Basic Education |
| **Module** | |

## 1.General information

## 1.1.Aims of the course

## 1.2.Context and importance of this course in the degree

## 1.3.Recommendations to take this course

## 2.Learning goals

## 2.1.Competences

## 2.2.Learning goals

## 2.3.Importance of learning goals

## 3.Assessment (1st and 2nd call)

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

## 4.Methodology, learning tasks, syllabus and resources

## 4.1.Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as:

- 1) Participatory lectures
- 2) Problems solving sessions
- 3) Laboratory practice sessions
- 4) Computer practice sessions
- 5) Autonomous work
- 6) Complementary activities
- 7) individualized or small groups tutorial

- 8) Support for training using available resources in the ADD of the University of Zaragoza http://add.unizar.es:800/newweb/web/index.html

Students are expected to participate actively in class throughout the semester.

Further information regarding the course will be provided on the first day of class

## 4.2.Learning tasks

The course includes the following learning tasks:

- 1) Participatory lectures taught in whole group. The material will be available on the website of the ADD of the University of Zaragoza. http://add.unizar.es:800/newweb/web/index.html.
- 2) Problems resolution classes taught in whole group. Cases and problems will be delivered in advance so that students could work them particularly.
- 3) Laboratory practices: attendance is compulsory unless exceptional cases. They will be held in small groups in 2 sessions of 3 hours each
- 4) Computer practices: attendance is compulsory unless exceptional cases. They will conducted in small groups in 1 session of 4 hours
- 5) Problems solving individually. Students will be provided with a collection of problems at the beginning of the semester. Each student will have to solve one of the problems of the collection in public session and chosen at random by the teachers of the subject.
- 6) Complementary activities related to the theme of the course include: presentation of news, debates and play trivial to learn genetics
- 7) Tutorials in small groups for preparation of seminars and troubleshooting
- 8) Individualized tutorials for solving doubts. The tutorial hours will be flexible and agreed in advance with the group depending on which is the most convenient schedule. In addition teachers can answer questions across different systems, including Moodle or email, always respecting rules and schedules that will be established with the group.

## 4.3.Syllabus

The course will address the following learning tasks:

SECTION I. NATURE AND ORGANIZATION OF HEREDITARY MATERIAL

- topic 1. DNA, genes and genomes. Nature and structure of DNA. DNA replication. Transcription. Genetic code and translation. Genes, introns and exons. Types of eukaryotic DNA. Genomes: size and number of genes.
- topic 2. Organization of the hereditary material in eukaryotes. Structure of eukaryotic chromosome. Levels of chromosome packing. Heterochromatin and euchromatin. Chromosomal bands. External structure of the chromosome. Centromere position, size and number. Extranuclear genetic material.
- topic 3. Organization of the hereditary material in prokaryotes. Introduction. Hereditary material in viruses and bacteria. RNA viruses. DNA viruses. Bacterial chromosome. Plasmids

SECTION II. TRANSMISSION OF HEREDITARY MATERIAL

- topic 4. Chromosomal theory of inheritance. Introduction. Cell cycle. Mitosis and hereditary material. Variations in the process of cell division. Meiosis. Biological and genetic significance of meiosis. Atypical meiosis. Differences between mitosis and meiosis.
- topic 5. Chromosome mutations. Basic concepts. Classification of mutations. Change in chromosome number. Aneuploidy. Euploidy. Chromosomal rearrangements. Human karyotype
- topic 6. Mendelian inheritance as genetic consequence of meiosis and fertilization. Rules of inheritance. Monohybrids: uniformity and segregation rules. Dihybrids: rule of independent combination. Polihybrids.
- topic 7. Gene interactions. Interactions between the alleles. Variations in dominance. Allelic series. Several genes affecting the same character. Lethal genes. Penetrance and expressivity
- topic 8. Sex determination and sex-linked characteristics. Genetic sex determination. X-linked inheritance. Y- linked

inheritance. Influence of sex on the inheritance of certain characters. Dosage compensation

SECTION III. LINKAGE AND RECOMBINATION

- topic 9. Linked genes. Linkage discovery. Types of crosses to explain gene linkage. Cis and trans dihybrid. Complete and incomplete linkage. Crosslinking and chiasmata.
- topic 10. Genome mapping in eukaryotes. I. Linkage maps. Basic concepts for the construction of a linkage map. Mapping using a dihybrid testcross. Frequency of recombinants.. Trihybrid testcross. Interference and coincidence. Relationship between genetic distance and frequency of recombination. Map unit and function map.
- topic 11. Genome mapping in eukaryotes. II. Physical maps. Interspecific somatic hybridization. In situ hybridization. Comparative mapping. DNA sequencing.

SECTION IV. POPULATION GENETICS

- topic 12. Basic concepts of population genetics. Gene and genotypic frequencies estimation. Hardy-Weinberg equilibrium in autosomal and sex-linked genes.
- topic 13. Changes in Hardy-Weinberg equilibrium I. Migration effect. Effect of mutation. Effect of selection in cases of complete dominance incomplete dominance and heterozygote selection. Mutation - selection balance.
- topic 14. Changes in Hardy-Weinberg equilibrium II. Small populations. Genetic drift. Effective population size. Inbreeding and its effects. Inbreeding coefficient calculation.

## 4.4.Course planning and calendar

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the Facultad de Ciencias website https://ciencias.unizar.es/grado-en-biotecnologia

## 4.5.Bibliography and recommended resources