COURSE DATA

Data Subject	
Code	33140
Name	Genetic analysis techniques
Cycle	Grade
ECTS Credits	4.5
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1109 - Degree in Biochemistry and Biomedical Sciences	Faculty of Biological Sciences	3	Second term

Subject-matter

Degree	Subject-matter	Character
1109 - Degree in Biochemistry and Biomedical Sciences	10 - Métodos instrumentales	Obligatory

Coordination

Name	Department
FERRE MANZANERO, JUAN	194 - Genetics
PARICIO ORTIZ, NURIA	194 - Genetics

SUMMARY

The subject of Genetic Analysis Techniques is taught in the third year of the Degree in Biochemistry and Biomedical Sciences (Plan 2009), in the second quarter of the year. This is a compulsory subject. Together with the Genetics-Cytogenetics, Genomics-Genetic Engineering (all mandatory subjects), Genetic Analysis Techniques aims to provide to students the basic knowledge about biological inheritance, as well as the conceptual and methodological tools that enable students to carry out, in a professional work, genetic analysis and genetic modification of organisms.

Students take this course after attending the subjects mentioned above; consequently they already have basic understanding of the biological inheritance and the genome structure and knowledge of molecular tools for genetic analysis.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

OUTCOMES

1101 - Degree in Biochemistry and Biomedical Sciences

- Capacidad para trabajar correctamente en los laboratorios de bioquímica, genética, biología molecular y celular incluyendo seguridad, manipulación, eliminación de residuos y registro anotado de actividades.
- Capacidad para utilizar la instrumentación básica en experimentación molecular y celular.
- Tener una visión integrada de las técnicas y métodos utilizados en biociencias moleculares y biomedicina.
- Capacidad para diseñar experimentos y aproximaciones multidisciplinares para la resolución de problemas concretos.
- Capacidad para presentar, discutir y extraer conclusiones de los resultados de los experimentos científicos.

LEARNING OUTCOMES

- Understanding and correctly applying the basic concepts of genetic analysis. Thus, the student will be able to:
    1. Know the importance (and value) of the mutants and neutral molecular variability in genetic analysis.
    2. Know the different types of molecular markers used in genetic analysis.
    3. Assign loci to specific chromosomes.
    4. Correlate genetic and cytogenetic maps using chromosomal deletions.
    5. Learn the techniques used in gene mapping in humans and in other organisms.
    6. Perform genetic maps in haploid eukaryotes.
    7. Perform physical maps using restriction enzymes.
    8. Know DNA profiling analysis for identifying individuals and determining relationships
- To encourage student plannig effort and independent learning in a continuous form.
- To foster critical view of different aspects of genetic analysis discussed throughout the course, emphasizing the capacity for synthesis and association between different concepts learned.
- Acquisition of ability and skills to design, plan and carry out laboratory experiments.
- Acquisition of ability to extend knowledge through the use of bibliographic sources, both from books, scientific journals and web pages.
- Acquisition of capability to discus from rational criteria, clearly differentiating what is arguable to what they are made or accepted with scientific evidence.
- Ability to interact with both the teacher and colleagues.

- Ability to build a comprehensive written text
- Acquisition of social and professional awareness about the ethical problems of genetic analysis.
- Professional training: ability and skills to deal with and solve analytic-genetic questions, especially related to gene mapping, molecular markers based linkage and determination of individual identity related to forensic genetics and paternity testing.

DESCRIPTION OF CONTENTS

1. LESSON 1. SEGREGATION AND RECOMBINATION MAPPING IN HAPLOIDS.

Segregation in haploids. Calculating gene-to-centromere distances. Calculating the distance between two loci. Three-point mapping in haploids. Problem solving.

2. LESSON 2. COMPLEMENTATION AND DELETION MAPPING.

Complementation test Mapping using deletions in species with giant chromosomes. Combined use of deletions and in situ hybridization for mapping human genes. Problem solving.

3. LESSON 3. TYPES OF GENETIC MARKERS.

Importance of biological variability in the genetic analysis. Morphological, biochemical and molecular markers. Identification of a molecular marker linked to a mutant phenotype. Problem solving.

4. LESSON 4. GENETIC IDENTITY.

Use of molecular markers to obtain genetic fingerprints. Probability assignment in forensic genetics. Probability assignment in paternity testing. Problem solving.

5. LESSON 5. LINEAGE MARKERS.

What are lineage markers. The use of Y-chromosome markers. The use of mitochondrial markers. Problem solving.

6. LESSON 6. ASSIGNING LOCI TO SPECIFIC CHROMOSOMES.

Use of linkage group markers in model species. Procedure in species with crossing-over limited to one of the two sexes. Procedure in species with crossing-over in both sexes. Problem solving.

7. LESSON 7. LINKAGE DETECTION IN HUMANS.

Linkage analysis in pedigrees. LOD score. Human-mouse somatic cell hybrids. Problem solving.

8. LESSON 8. OBTAINING RESTRICTION MAPS.

Restriction maps. The use of probes. Circular maps. Linear maps. Problem solving.

9. LABORATORY PRACTICALS

LAB PRACTICAL 1. USE OF MOLECULAR MARKERS. Linkage of a mutant phenotype to a molecular marker using the RAPDs technique.
LAB PRACTICAL 2. SEGREGATION IN HAPLOIDS. Ordered tetrad analysis (estimate the gene-centromere distance in Sordaria fimicola).
LAB PRACTICAL 3. GENE LOCALIZATION BY DELETION MAPPING. Precise gene localization using chromosome deletions in Drosophila melanogaster.
LAB PRACTICAL 4. GENETIC IDENTITY. Obtaining a genetic fingerprint from saliva and blood DNA, by means of genetic and biochemical markers.

WORKLOAD

ACTIVITY	Hours	% To be attended
Classroom practices	21,00	100
Laboratory practices	18,00	100
Tutorials	3,00	100
Theory classes	3,00	100
Development of individual work	5,00	0
Study and independent work	22,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	16,00	0
Preparation of practical classes and problem	10,00	0
Resolution of case studies	9,50	0
TOTAL	**112,50**	

TEACHING METHODOLOGY

The following teaching methods will be used to develop this subject:

1. Theory and problem classes. A total of 16 sessions of one-hour and a half will be needed to cover this teaching activity in groups of 40 students. The professor will show the most relevant concepts needed to solve the different questions related to each topic. After that several practical problems will be solved.

2. Laboratory classes. Five sessions of 3 hours long will be held in groups of 16 students. Attendance is compulsory for laboratory classes.

3. Group mentoring. Two sessions of one hour and a half are organized in groups of 16 students. Its aim is to review and discuss the concepts taught during the course. In addition, the final half hour of each session will be devoted to the completion of a written test to evaluate the knowledge acquired by the students. It is intended that these tutorials will stimulate the sustained study of the subject.

4. Personalized tutoring. Students will be encouraged to use this resource for advice and discussion with the teacher any topic about the program, the course, or the degree studies.

EVALUATION

Application of the acquired concepts to the problem solving: The evaluation of the concepts worked in the theoretical-practical sessions of problems will be made through a final written exam, which will consist of the presentation of problems and / or questions on any of the aspects dealt with in the classes of problems and tutorials, and two written tests during the group tutorials (about the two parts of the subject). The value of the final test will be 60% of the total, and the value of the two partial tests will be 10%. Both marks will be averaged, weighted (6: 1), only if the mark of the tutorials is higher than that of the final exam (ie, only if it benefits the student).

Laboratory: Evaluation of the learning in the laboratory, taking into account the attendance, as well as the presentation of a questionnaire on the results of the lab exercices and the analysis of the same. The value of the laboratory mark will be 30% of the total. The attendance to the laboratory classes is obligatory and essential to pass the subject.

Portfolio of the student: In addition, the student can get up to 1.3 extra points in the final score of the problems part with his "portfolio". This consists of having obtained a score of 8.5 or higher in the set of two partial tests in the group tutorials. The application of the portfolio will consist of multiplying by 1.1 the score obtained in the weighted average of the problems section.

Summary of the evaluation system:

Other considerations:

The final grade results from the sum of the grades achieved in the different sections. To pass the course is necessary to obtain an overall rating equal to or higher than 5 points out of 10, taking into account that the score of theoretical and practical knowledge (upon addition of the "portfolio") and laboratory skills are either, independently, 4,5 or more out of 10.

Students who have not passed the subject in the first call, their marks of the theoretical and practical knowledge will be saved for the second call when they are equal to or higher than 5 points out of 10. However the student can waive these marks performing the corresponding section in the examination of the second call. The score obtained from the laboratory skills is saved for the second call if necessary and for the next year, as well as for subsequent years.

Students who do not assist to the final exam will have NOT EVALUATED in the records.

To apply for an advance of the examination of this course the student must have completed (in any of the previous years) the laboratory classes of this subject.

REFERENCES

Basic

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Additional

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Interamericana).
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Recursos informáticos:

1. Sociedad Española de Genética, http://www.segenetica.es/
Se recomienda visitar el apartado de docencia: hay lecciones, problemas y recursos multimedia.
2. Página web del libro Genética, un enfoque conceptual. En inglés.
http://www.whfreeman.com/pierce3e/
Se encuentran recursos complementarios a los del libro, tales como animaciones, resolución de problemas y enlaces de interés.
3. DNAi.org (DNA interactive) En inglés, http://www.dnai.org/index.htm
4. DNA from the beginning. En ingles, http://www.dnaftb.org/
5. Libro de texto de Genética disponible como libro electrónico en la Biblioteca de Ciencias:
Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. y Carroll, S.B. (2013). Genética, 9a edición. McGraw-Hill-Interamericana. ISBN: 978-84-481-9090-3.