COURSE DATA

Data Subject	
Code	42600
Name	Genetics
Cycle	Master's degree
ECTS Credits	9.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
2116 - Master's Degree in Bioinformatics	School of Engineering	1	First term

Subject-matter

Degree	Subject-matter	Character
2116 - Master's Degree in Bioinformatics	15 - Genetics	Optional

Coordination

Name	Department
GARCIA ROBLES, INMACULADA ROSA	194 - Genetics
PASCUAL CALAFORRA, LUIS FCO.	194 - Genetics

SUMMARY

Genetics is the part of biology that deals with the study of heredity and variation in organisms. Genetics The course is taught in the first quarter of Masters in Bioinformatics at the University of Valencia with a theoretical and practical methodology to supplement training for graduate students in Computer Science or related.

The overall objectives of this course are to provide the student with basic knowledge concerning the study of biological variability and the mechanisms that regulate their heritage, to study the structure and function of genes and genomes, as well as conceptual and methodological tools which enable to carry out any type of genetic analysis.

The delivery of content has been coordinated with the other three subjects that are part of training supplements aimed at software engineers or related: Medical and clinical experimentation, Evolution and Biochemistry and Molecular Biology.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

None

COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

2116 - Master's Degree in Bioinformatics

- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.
- Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- Students should demonstrate self-directed learning skills for continued academic growth.
- Be able to access the information required (databases, scientific articles, etc.) and to interpret and use it sensibly.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.

LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

• Understanding the mechanisms of biological inheritance.

• Know the methods of global analysis of structural and functional genomics and cellular processes.

• Understand the structure, function and variation of genomes.

• Understand the basic concepts and applications of recombinant DNA technology and genetic engineering.

• Gain an integrated view of the techniques and methods used in genetics.

• Understanding the genetic regulation of development of organisms.

DESCRIPTION OF CONTENTS

1. Introduction to Genetics.

Definition and objectives of genetics. Basics: genotype, phenotype and norm of reaction. Phenocopy. The genetic analysis. Mutation: definition and types. Relations between alleles

2. Patterns oh inheritance

Gregor Mendel: the reasons for success. Monohybrid cross: Law of segregation. The test cross. Dihybrid cross: Law of the transmission. Genetic notation. The use of branching diagrams and tables of double entry. The chi-square test. Cytological basis of heredity: mitosis and meiosis. Genetic consequences of meiosis

3. Extensions of Mendelian analysis

AB0 blood group system, an example of multiple allelism. Analysis of polihybridism. The study and calculation of probabilities in pedigrees. Relationships between genes: interaction and epistasis. Lethality. Penetration and expressiveness. Pleiotropy. A. Garrod and inborn errors of metabolism. G. Beadle, E. Tatum and the onset of biochemical genetics. The genetic complementation.

4. Chromosomes, sex and heredity

Chromatin: composition and organization. From the nucleosome to the metaphasic chromosome. Centromere, telomere and nucleolar organizer. Morphology and chromosome number. karyotype. Staining of chromosomes. Hybridization "in situ" as a technique for chromosome identification. Establishment of the chromosome theory of heredity. Linked inheritance sex chromosomes. Dosage compensation. Sex determination systems. Role of X and Y chromosomes in Drosophila and humans. Influence of sex on inheritance and gene expression. Influence of environment on gene expression.

5. Genetic linkage and genetic mapping

The transfer of linked genes. Meiotic recombination. Detection of linkage. Recombination, genetic distance and linkage map.
The map of three points. How to proceed when we do not know the order of genes. Genetic distance and physical distance. The phenomenon of interference. Double crossovers and map functions. Distance from the dihybrid. Linkage analysis in pedigrees: lod score.

6. Recombinant DNA and Genetic engineering

Basics of recombinant DNA technology. Obtaining of recombinant DNA. Cloning and cloning vectors. Isolation of a gene of interest. Detection of a gene. Polymerase chain reaction. Sequencing of nucleic acids. Directed mutagenesis.

7. Genomics and Proteomics

Concept of genomics. Structural genomics. Human Genome Project. Comparative Genomics. Functional genomics. Proteomics. Systems Biology. Metagenomics.

8. Structure and organization of the nuclear genomes of eukaryotes

Location and organization of nuclear genes to genomes. Estimates of the number and function of genes. Content and localization of repetitive DNA

9. Structure and organization of genomes of prokaryotes and organelles

Physical characteristics of prokaryotic genomes. Genetic characteristics of prokaryotic genomes: organization, number and function of genes. Origins and physical characteristics of the organelle genomes. Genetic content of organelle genomes.

10. Structure and organization of genomes of viruses and transposons

Characteristics and strategies of genome replication of bacteriophages. Characteristics and strategies of viral genome replication of eukaryotes. Mobile genetic elements. Transposition through an RNA intermediate. DNA transposons.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	27,00	100
Attendance at events and external activities	5,00	0
Development of group work	5,00	0
Development of individual work	15,00	0
Study and independent work	43,00	0
Readings supplementary material	30,00	0
Preparation of evaluation activities	25,00	0
Preparing lectures	20,00	0
Preparation of practical classes and problem	27,00	0
Resolution of case studies	10,00	0

TOTAL	**207,00**

TEACHING METHODOLOGY

MD1 - Task training of the teaching-learning environment interaction in the classroom through expository sessions. Previous assignments include preparation (information search, reading texts supplied by teachers), teaching sessions themselves and the later work of deepening.

MD2 - Learning through case study analysis, through which it is acquiring skills on different aspects of materials and subjects.

MD4 - Cross-disciplinary skills. Include attendance at courses, conferences or round tables organized by the CEC of the Master and / or conduct of a bibliographic work on issues that contribute to the integral. It produces a report of activities.

EVALUATION

The assessment of learning knowledge and skills achieved by students will consider all facets of it and will essentially continuously throughout the course in order to detect possible shortcomings time student and be able to advise and help in their task. It will be therefore very important teacher-pupil relationship and knowledge on his part on the degree of learning achieved by students which will facilitated by personal tutorials.

However, in order to give a numerical rating of the degree of knowledge and skills gained by the student, will be carried out various tests that attempt to measure these from the various educational activities developed. Thus:

SE1 Continuous assessment 10%

SE2 Activities 60%

SE4 Test 30%

REFERENCES

Basic

- Referència b1: Pierce B. (2009) Genética. Un enfoque conceptual. 3ª edición. Ed. Médica Panamericana.
  ISBN: 978-84-9835-216-0
- Referència b2: Brown, T.A. (2008). Genomas. 3ª ed. Ed. Médica Panamericana.
  ISBN: 978-950-06-1448-1

- Referència b3: Ménsua, José L. (2003). Genética. Problemas y ejercicios resueltos. Ed. Pearson. ISBN: 9788420533414.

Additional

- Referència c1: Klug, W., Cummings, M.R. y Spencer C. A. (2006). Conceptos de Genética. 8ª edición. Pearson.
ISBN: 9788420550145
- Referència c2: Griffiths, A.J.F., Miller, J.H., Suzuki, D.T., Lewontin, R.C. y Gelbart, W.M., (2002). Genética, 7a edición. McGraw-Hill-Interamericana.
ISBN: 84-486-0368-0
- Referència c3: DNAi.org (DNA interactive). En inglés (http://www.dnai.org/index.htm)
- Referència c4: DNA from the beginning. En inglés. (http://www.dnaftb.org/).
- Referència c5: Scitable. A Collaborative Learning Space for Science. Genetics. (http://www.nature.com/scitable/topic/genetics-5).