UAB
Universitat Autònoma de Barcelona

Comparative Genomics

2026/2027

Code: 45796
Credits: 6

Degree programme	Type	Course
Cytogenetics and Reproductive Biology	OP	1

Contact lecturer

Name : Aurora Ruiz-Herrera Moreno

Email : aurora.ruizherrera@uab.cat

Teaching staff

Sònia Casillas Viladerrams

Covadonga Vara Gonzalez

Group languages

You can consult this information at the end of the document.

Prerequisites

- BSc in Biology, Biomedical Sciences, Genetics or Biotechnology or in their equivalents in the curricula. Graduates or graduates of degrees in the field of Biosciences may also access.

- Basic knowledge of Catalan (level B1) or Spanish (level B1) (only for students who do not have Catalan or Spanish as their mother tongue).

Objectives

Comparative Genomics provides a broad perspective both in the evolution of species and in the origin of human diseases through the study of genomic sequences. The content of the module will address broad aspects of the area such as evolutionary cytogenetics, methodologies for studying genomes, as well as the latest advances in animal and plant comparative genomics. Comparative Genomics is a very dynamic and constantly evolving field, so the teaching methodology will include master classes of specialists that will present the latest advances in the subject as well as seminars by students where scientific articles are presented and discussed.

Learning outcomes

- CA14 (Design scientific experiments in the field of comparative genomics, selecting appropriate methodologies and tools to respond to research hypotheses.) Design scientific experiments in the field of comparative genomics, selecting appropriate methodologies and tools to respond to research hypotheses.

- CA15 (Integrate knowledge and skills within the area of comparative genomics to develop and defend their own academic work.) Integrate knowledge and skills within the area of comparative genomics to develop and defend their own academic work.
- KA17 (Relate the cellular and molecular foundations of genome organisation to the evolutionary processes determining its diversity.) Relate the cellular and molecular foundations of genome organisation to the evolutionary processes determining its diversity.
- KA18 (Identify the origin and cellular and molecular foundations of human pathologies associated with chromosomal abnormalities in the context of comparative genomics, considering their evolutionary relevance.) Identify the origin and cellular and molecular foundations of human pathologies associated with chromosomal abnormalities in the context of comparative genomics, considering their evolutionary relevance.
- KA19 (Interpret the chromosomal changes described in the scientific literature related to evolutionary processes involved in speciation in animals.) Interpret the chromosomal changes described in the scientific literature related to evolutionary processes involved in speciation in animals.
- KA20 (Explain the scientific, socio-economic and environmental impact of research in the field of comparative genomics and evolutionary cytogenetics.) Explain the scientific, socio-economic and environmental impact of research in the field of comparative genomics and evolutionary cytogenetics.
- SA19 (Interpret the chromosomal changes related to evolutionary processes that have given rise to the human karyotype in the field of comparative genomics.) Interpret the chromosomal changes related to evolutionary processes that have given rise to the human karyotype in the field of comparative genomics.
- SA20 (Apply bioinformatics resources and tools in the comparative analysis and functional interpretation of genomic data.) Apply bioinformatics resources and tools in the comparative analysis and functional interpretation of genomic data.
- SA21 (Demonstrate communication skills, both oral and written, through the presentation of scientific data and the preparation of literature review works related to comparative genomics.) Demonstrate communication skills, both oral and written, through the presentation of scientific data and the preparation of literature review works related to comparative genomics.

Contents

The contents of this subject include basic and specific concepts on evolutionary cytogenetics, advances in the area of comparative genomics, genome reconstruction models as well as the application of bioinformatics tools in the knowledge of animal and plant species.

Evolutionary cytogenetics. Chromosomal variability. Criteria of karyotype ordering. Chromosomal sex. Karyotype / species. Models of chromosomal speciation.

Methodologies for the study of genomes. Mass sequencing techniques. Study of the structural variations of the genome. Databases. Study of chromatin conformation (3C, 5C and Hi-C).

Animal Comparative Genomics. "In silico" study of complete genomes. Evolutionary breakpoints. Synthenic genomic blocks. Phylogenomics. Ratios of chromosomal evolution. Repetitive elements and recombination.Genomics of primates and other mammals.

Plant Comparative Genomics. Karyotypic diversity, genome structure, synthetic groups, genomic evolution of plant species.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Material preparation	15	0.6	CA14, CA15, KA17, KA19, SA19, SA20, SA21
Classes	22	0.88	CA14, CA15, KA17, KA18, KA19, KA20, SA19
Reading of relevant papers	11.5	0.46	CA15, KA17, KA18, SA19
Bibliography	11	0.44	CA15, KA17, KA18, KA19, SA19
Computer practices	8	0.32	SA20
Presentations	10	0.4	KA20, SA21
Study	68	2.72	CA15, KA17, KA18, KA19, SA19

The subject will be taught following the guidelines of the European Higher Education Area (EHEA). This implies an active participation of the students in their own learning process and will result in a participation of the students in class and an interaction between them and the teaching staff.

Comparative genomics is a very dynamic and constantly evolving field, so the teaching methodology will include master classes of specialists that will present the latest advances in the subject as well as seminars by students where scientific articles are presented and discussed. The following describes the organization and teaching methodology that will be followed.

1. Master classes: The content of the theory program will be taught in master classes. They will be made with audiovisual material prepared by the teacher.

2. Reading and commenting on articles and / or texts of interest: The master classes will be complemented with readings of scientific articles on the topics discussed.

3. Practical session on browsers of the human genome

4. Elaboration of a paper

5. Autonomous study

Annotation: within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes
Written exams	35%	1.5	0.06	CA14, CA15, KA17, KA18, KA19, KA20, SA19
Oral dissertation	20%	1	0.04	KA20, SA21
Attendance and active participation	10%	0.5	0.02	SA21

Paper delivery	35%	1.5	0.06	SA20, SA21

Paper delivery: 35%

Oral dissertation: 20%

Written exams: 35%

Attendance and active participation: 10%

For this course, the use of Artificial Intelligence (AI) technologies is permitted exclusively for support tasks, such as literature and information searches, text editing, or translation in the preparation of support materials. Students must clearly identify which parts have been generated using these technologies, specify the tools employed, and include a critical reflection on how these tools have influenced both the process and the final outcome of the activity. Failure to transparently disclose the use of AI in this assessed activity will be considered a breach of academic integrity and may result in a partial or total reduction of the activity grade, or more severe sanctions in serious cases.

Any irregularity committed during an assessment activity (academic misconduct, plagiarism, or improper use of AI, unless such use is expressly authorized in the course syllabus) that may lead to a significant alteration of the grade will result in that activity being graded as 0. If the course syllabus stipulates that obtaining a minimum mark in this assessment is an essential requirement to pass the course, or if multiple irregularities occur in the assessment activities of the same course, the final grade for the course will be 0. Furthermore, disciplinary proceedings may be initiated against any student who incurs any of these irregularities.

Bibliography

http://www.ncbi.nlm.nih.gov/

http://www.discoverlife.org/mp/20m?tree=Life&flags=all

http://www.ensembl.org/index.html

http://genome.ucsc.edu/

http://www.broadinstitute.org/scientific-community/science/projects/mammals-models/mammalian-genome-projec

http://timetree.org/index.php

http://genome10k.soe.ucsc.edu/

http://www.mouseencode.org/

https://www.earthbiogenome.org/

Software

Ensembl (https://www.ensembl.org/Homo_sapiens/Info/Index)

PopHuman (https://pophuman.uab.cat/)

UCSC (http://genome.ucsc.edu/)

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this link. To access the information, you will need to enter the course CODE