Universitat Autònoma de Barcelona

2023/2024

Genomics

Code: 42925
ECTS Credits: 6

Degree	Type	Year	Semester
4313802 Advanced Genetics	OB	0	1

Contact

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Teaching groups languages

You can check it through this link. To consult the language you will need to enter the CODE of the subject.
Please note that this information is provisional until 30 November 2023.

Teachers

Antoni Barbadilla Prados

Maria del Pilar Garcia Guerreiro

Jaime Luis Martinez Urtaza

Barbara Negre De Bofaull

Marta Puig Font

Sonia Casillas Viladerrams

External teachers

Marina Laplana Lafaja

Prerequisites

Languages: Lectures will be mainly in English

Postgraduates in Biochemistry, Biotechnology, Biology, Biomedicine, Genetics, Microbiology, Chemistry, Informatics/Bioinformatics, Pharmacy, Medicine and Veterinary Medicine

Objectives and Contextualisation

The overall aim of the subject is to provide students an overview of genomics including fundamentals, current techniques and applications. The specific objectives include understanding the following aspects: the diversity and complexity of eukaryotic genomes, the historical and evolutionary perspective of genomic content, the

meaning and consequences of intraspecific variability, techniques commonly employed in studies of genomics, metagenomics and transcriptomics and applications derived from the knowledge provided by this science.

Competences

- Conceive, design, carry out and synthesise scientific projects in the area of genetics, both theoretical and applied.
- Demonstrate a mastery of genetic analysis as a transversal tool applicable to any field of genetics.
- Demonstrate responsibility in management of information and knowledge.
- Demonstrate responsibility in the direction of groups and/or projects in multidisciplinary teams.
- Develop critical reasoning in the area of study and in relation to the scientific and business environments.
- Identify and propose scientific solution for problems related to genetic research at both molecular and organism levels and demonstrate an understanding of the complexity of living beings.
- Identify and use biocomputing tools to contribute to knowledge of the genomics of different organisms.
- Integrate genetic analysis at different levels of complexity (molecular, cell, individual, population) to coherently resolve different problems in the area of genetics.
- Integrate knowledge of the possible alterations in DNA with their consequences for living beings.
- Student should possess an ability to learn that enables them to continue studying in a manner which is largely self-supervised or independent.
- Students should know how to apply the knowledge they acquire and be capable of solving problems in new or little-known areas within broader contexts (or multidisciplinary contexts) related to their area of study.
- Students should know how to communicate their conclusions, knowledge and final reasoning that they hold in front of specialist and non-specialist audiences clearly and unambiguously.
- Understand the genetic techniques necessary for improving biological processes and their acceptability in economic and health terms.
- Use and manage bibliographical information and other resources related to genetics and related fields.
- Use scientific terminology to argue the results of the research and show how to communicate in spoken and written English in an international setting.

Learning Outcomes

1. Analyse the importance of genomics, from a theoretical and applied viewpoint, when planning scientific projects.
2. Analyse the role that different changes in DNA have played in gene evolution.
3. Analyse the role that different genetic changes have had as mechanisms for genomic change.
4. Apply strategies and techniques to isolate genomic regions for specific purposes.
5. Appreciate the strategic, industrial and economic importance of genomics in life sciences, health sciences and society.
6. Demonstrate responsibility in management of information and knowledge.
7. Demonstrate responsibility in the direction of groups and/or projects in multidisciplinary teams.
8. Describe and identify the different components present in genomic eukaryotes.
9. Describe the complexity of genomes according to the complexity of the organism.
10. Describe the organisation, evolution, expression and population variation of the human genome.
11. Present summaries and conclusions in public.
12. Search for and make explicit the necessary bibliography for understanding the work related to genomics in biocomputing and evolution.
13. Student should possess an ability to learn that enables them to continue studying in a manner which is largely self-supervised or independent.
14. Understand the different methodologies, techniques and tools used habitually in sequencing, assembly and annotation of genomes.
15. Understand the types and levels of genetic variability in populations as well as their significance and application in medicine and genetic improvement.
16. Use knowledge of biocomputing for managing genome databases.

17. Use scientific terminology to argue the results of the research and show how to communicate in spoken and written English in an international setting.
18. Write critical summaries about the taught seminars.

Content

Introduction to Genomics.

The human Genome.

Genomic Technologies.

Metagenomics

Transposable Elements.

Comparative Genomics: Chromosomal changes.

Comparative Genomics: Nucleotide sequence changes.

Structural variation.

Population Genomics: Theory.

Population Genomics: Data. Studies in Model Species.

Population Genomics in Humans.

Association Studies/System genetics.

Functional Genomics and Transcriptomics.

Epigenomics.

Methodology

Subject teaching includes three types of activities:

- Lectures. Spoken explanations of the subject that is to be learned accompanied by powerpoint presentations to help students visualize cuestions and answers.
- Reading and discussion. Students are expected to read a number of research papers during the course and participate in the critical discussion of the papers in the class room.
- Oral presentations. Students will prepare a subject and make an oral and powerpoint presentation of the subject to their their peers.

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.

Activities

Title	Hours	ECTS	Learning Outcomes

Type: Directed		
Lectures	24	0.96
Oral presentations	8	0.32
Student work, reading and learning	118	4.72

Assessment

Final grades are a weighed average of following items:

- Attendance and participation in the classroom (20%)
- Oral presentation and defense (40%)
- Exam (40%)

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Exam	40%	0	0	3, 2, 4, 15, 14, 8, 10, 9, 5
Lecture attendance and participation	20%	0	0	2, 1, 12, 15, 14, 8, 10, 9, 18, 11, 13
Oral presentations	40%	0	0	12, 7, 6, 18, 11, 13, 16, 17

Bibliography

Basic books

- Gibson, G. & S. V. Muse, 2009 (3rd edition). A Primer of Genome Science. Sinauer, Massachusetts. USA.

- Brown, T. A. 2017. Genomes 4 (4th edition). Garland Science, New York, USA.

- Lesk, A.M. 2017. Introduction to genomics (3rd edition). Oxford University Press, Oxford, UK.

- Lynch, M. 2007. The origins of genome architecture. Sinauer.

- Strachan, T. & A. Lucassen, 2023. Genetics and Genomics in Medicine (2nd edition). CRC Press

Useful links

http://bioinformatica.uab.es/mastergp
UAB Virtual Campus: https://cv2008.uab.cat/
Entrez Genome Database: http://www.ncbi.nlm.nih.gov/genome

Software

NA