Universitat Autònoma de Barcelona

2023/2024

Cancer Genetics

Code: 101972
ECTS Credits: 6

Degree	Type	Year	Semester
2500890 Genetics	OT	4	2

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

Jordi Surralles Calonge

Monica Pujol Canadell

Jordi Camps Polo

Alba Hernandez Bonilla

Prerequisites

To have basic knowledge on Human Genetics.

In order to be able to attend the laboratory classes, it is necessary that the student shows that he/she has passed the biosafety tests that can be found in Campus Virtual. He/she must know and accept laboratory standards of practice from Faculty of Biosciences.

Objectives and Contextualisation

The objectives of the course are to show how the acquisition of somatic mutations contribute to tumor growth and how genetic variations contribute to inherited susceptibility to cancer. Some issues such as genomic instability and the types of functional changes that result in tumor growth are addressed. We also discuss the genetic and epigenetic changes in cancer , from the chromosomal scale up to small mutations, with examples of the most common cancers.

Competences

- Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
- Apply knowledge of theory to practice.
- Appreciate the importance of quality and a job well done.
- Be able to analyse and synthesise.
- Be able to communicate effectively, orally and in writing.
- Be sensitive to environmental, health and social matters.
- Design and interpret studies associating genetic polymorphisms and phenotypical characters to identify genetic variants that affect the phenotype, including those associated to pathologies and those that confer susceptibility to human illnesses or those of other species of interest.
- Develop creativity.
- Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
- Measure and interpret the genetic variation in and between populations from a clinical, conservational and evolutionary perspective, and from that of the genetic improvement of animals and plants.
- Show an understanding of the genetic bases of cancer.
- Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
- Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.

Learning Outcomes

1. Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
2. Apply knowledge of theory to practice.
3. Appreciate the importance of quality and a job well done.
4. Be able to analyse and synthesise.
5. Be able to communicate effectively, orally and in writing.
6. Be sensitive to environmental, health and social matters.
7. Describe the role of genetic variation in the human species in the diagnoses, prevention and treatment of illnesses.
8. Develop creativity.
9. Integrate knowledge of the different techniques for analysing variation of genetic material and its theoretical bases in the evaluation and interpretation of results from a clinical perspective.
10. Interpret the results obtained using techniques for the analysis of DNA polymorphisms to identify and evaluate factors of susceptibility and propensity to suffer illnesses.
11. Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
12. Show an understanding of the genetic bases of cancer.
13. Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
14. Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.

Content

1. What is cancer? Types of tumors. Benign and malignant tumors. Incidence and survival.

2. Characteristics of tumor cells. Cell signalling. Cell cycle control. Angiogenesis. Inactivation of senescence. Apoptosis. Invasiveness and metastasis. Tumor microenvironment. Therapeutic targets.

3. Genes and cancer. Epigenetics and cancer. Methylation. Modification of histones. miRNAs. Potential clinical use.

4. Sequencing the cancer genome. Driver and passenger mutations. Number of mutations required. Circo Plots. Pathways with more alterations. Mutations associated with metastasis. Gene expression profiles.

5. Genetic alterations in leukemia and lymphoma.

6. Genetic alterations of the most frequent carcinomas. Lung cancer, colon cancer, breast cancer, bladder cancer, prostate cancer, kidney cancer.

7. New genetic strategies applied to the diagnosis and treatment of cancer. Tumor heterogeneity. Mutational signatures. Screening in colon cancer. Biomarkers

8. Carcinogenesis. Embryonic stem cells (SCS) and cancer stem cells (CSCS). The cancer stem cell hypothesis. Implications in cancer therapy. Implications in the generation of artificial stem cells. Analysis techniques of the CSC and the tumor phenotype.

9. Environmental carcinogenesis. Molecular mechanisms of environmental carcinogenesis. Human carcinogens. Transplacental carcinogens.

10. Familial cancer, DNA repair and cancer predisposition syndromes

11. Genetic strategies to identify cancer susceptibility genes

12. New treatments for tumors with mutations in genes of tumor predisposition. The concept of synthetic lethality

Methodology

The teaching methodology will benefit from the tools provided by the Virtual Campus of the UAB. To achieve the objectives of the subject, three types of learning activities are proposed: theoretical sessions, seminars with half of the group and laboratory practices also with half of the group.

Theoretical sessions: The students acquire their own knowledge of the subject attending the classes, complementing them with the personal study. These classes are designed as lecture sessions by the teaching staff but also the active participation of students is encouraged to establish discussions or collective reflections, using Information and Communications Technologies and Learning and Knowing Technologies. In the classes, digital presentations are used to help the understanding of the contents, which are available on the UAB virtual campus.

Seminars: The knowledge developed in the theory classes and worked in the personal study is applied to the resolution of practical cases, attendance at conferences and the discussion of original research papers published in international journals. Practical cases arise in the form of problems or questions, which are worked on small groups. These type of methodology allow us to reinforce and deepen the topics studied in the theoretical sessions.

Laboratory practices: The practical laboratory classes are essential for the learning of any knowledge in the field of experimental sciences. In the case of the course of Cancer Genetics, the practical classes have as objective to show to the students some techniques of tumor genome analysis. The learning and understanding of these techniques will allow the acquisition of skills that will be essential for the professional development of students. The attendance to the laboratory sessions is compulsory.

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			
Laboratory exercises	10	0.4	2, 6, 8, 5, 4, 3
Seminars	15	0.6	2, 6, 8, 5, 4, 3
Theoretical sessions	25	1	2, 6, 8, 5, 4, 3
Type: Supervised			
Tutorials	2	0.08	2, 6, 8, 5, 4, 3
Type: Autonomous			
Personal study	60	2.4	2, 6, 8, 4, 3
Preparation of seminar activities	35	1.4	2, 6, 8, 5, 4, 3

Assessment

a) Two written tests: each test is 30% of the final mark. The minimum mark to pass the subject will be 5 in each test.

b) Reports derived from the activities carried out in the seminars: 30% of the final mark. The works can be problems, interpretation of data, bibliographical research, etc. to be proposed by each responsible professor.

c) Questions or report on laboratory practices: 10% of the final mark. The attendance to the laboratory sessions is compulsory.

To be able to pass the subject, the minimum mark is 5. At the end of the course there will be a remedial test for those students who have failed or not attended any of the two written tests. To be eligible for the remedial exam, the student should have been previously evaluated in a set of activities equaling at least two thirds of the final score of the course. The student will be graded as "No Avaluable" if the weighthin of all conducted evaluation activities is less than 67% of the final score.

Unique assessment

Students enrolled in the single assessment will have to take the two written tests and hand in the assignments from works performed in the classes on a single date, only for those that are not in group (under the same conditions as students with continuous assessment). The works performed in the classes that are in group will be assessed on the same day that the students with continuous assessment will be assessed. Laboratory classes are of mandatory attendance and will be assessed on the same day that students with continuous assessment. The percentage of each assessment activity will be the same as in continuous assessment. The single assessment test will coincide with the same date fixed in the calendar for the last continuous assessment test and the same recovery system will be applied as for the continuous assessment.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Practical excercises	10%	0	0	1, 14, 13, 2, 12, 6, 7, 8, 9, 10, 11, 5, 4, 3
Seminar reports	30%	0	0	1, 14, 13, 2, 12, 6, 7, 8, 9, 10, 11, 5, 4, 3

Written test I	30%	1.5	0.06	2, 12, 7, 9, 10, 5, 4, 3
Written test II	30%	1.5	0.06	2, 12, 7, 9, 10, 5, 4, 3

Bibliography

The molecular basis of cancer. Edited by:J. Mendelsohn, P.M. Howley, M.A. Israel, J.W. Gray, C.B. Thompson. Philadelphia: Saunders, an imprint of Elsevier Inc. 2015. 4th edition.
https://www.sciencedirect.com/science/book/9781455740666

Principles of cancer genetics. Edited by: F. Bunz. Baltimore: Springer. 2022. 3rd edition.
https://link-springer-com.are.uab.cat/book/10.1007/978-3-030-99387-0

Textbook of cancer epidemiology. Edited by: Hans-Olov Adami, David Hunter, and Dimitrios Trichopoulos. Oxford University Press. 2018. 3rd edition.

Review articles that will be in the Virtual Campus of UAB

Software

No specific software will be used