

**Genetics of Cancer and Oncology**

Code: 101882  
ECTS Credits: 6

Degree	Type	Year	Semester
2501230 Biomedical Sciences	OT	4	0

### Contact

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### Use of Languages

Principal working language: catalan (cat)  
Some groups entirely in English: No  
Some groups entirely in Catalan: Yes  
Some groups entirely in Spanish: No

### Teachers

Rosa Miró Ametller  
Jordi Surrallés Calonge  
Iolanda Álvarez Cobo  
Jordi Camps Polo  
Alba Hernández 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

- Apply knowledge acquired to the planning and implementation of research, development and innovation projects in a biomedical research laboratory, a clinical department laboratory or the biomedical industry.
- Contribute to public discussions on cultural matters.
- Develop critical thinking and reasoning and communicate ideas effectively, both in the mother tongue and in other languages.
- Develop independent learning habits and motivation to continue training at postgraduate level.

- Develop independent learning strategies.
- Develop scientific knowledge, critical reasoning and creativity.
- Display knowledge of the concepts and language of biomedical sciences in order to follow biomedical literature correctly.
- Display theoretical and practical knowledge of the major molecular and cellular bases of human and animal pathologies.
- Generate innovative and competitive proposals for research and professional activities.
- Identify and understand the advances and challenges of research.
- Read and critically analyse original and review papers on biomedical issues and assess and choose the appropriate methodological descriptions for biomedical laboratory research work.
- Respect diversity in ideas, people and situations.
- Show respect for the ethical and legal aspects of research and professional activities.
- Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.

## Learning Outcomes

1. Contribute to public discussions on cultural matters.
2. Correctly use the terminology of medicine and its text and reference books
3. Develop critical thinking and reasoning and communicate ideas effectively, both in the mother tongue and in other languages.
4. Develop independent learning habits and motivation to continue training at postgraduate level.
5. Develop independent learning strategies.
6. Develop scientific knowledge, critical reasoning and creativity.
7. Generate innovative and competitive proposals for research and professional activities.
8. Identify and understand the advances and challenges of research.
9. Identify the principal pathologies that become more prevalent with ageing.
10. Propose research projects that are relevant to human pathology.
11. Respect diversity in ideas, people and situations.
12. Show respect for the ethical and legal aspects of research and professional activities.
13. Understand scientific texts on pathology of the different systems and write review papers on these.
14. Understand the molecular and cellular bases of cancer, the causes of its development and the bases for its treatment.
15. Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.

## 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. Oncogenes and tumor suppressor genes. Type and function. Activation / inactivation. Model of retinoblastoma. P53. Loss of heterozygosity.
4. Epigenetics and cancer. Methylation. Modification of histones. miRNAs. Potential clinical use.
5. 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.
6. Genetic alterations in leukemia and lymphoma.
7. Genetic alterations of the most frequent carcinomas. Lung cancer, colon cancer, breast cancer, bladder cancer, prostate cancer, kidney cancer.
8. New genetic strategies applied to the diagnosis and treatment of cancer. Tumor heterogeneity. Mutational signatures. Screening in colon cancer. Biomarkers

9. 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.

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

11. Familial cancer, DNA repair and cancer predisposition syndromes

12. Genetic strategies to identify cancer susceptibility genes

13. 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 of theory, complementing them with the personal study. These classes are designed as lectures given by the teaching staff but also the active participation of students is encouraged to establish discussions or collective reflections. 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 exercises:** 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.

## Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory exercises	10	0.4	12, 14, 1, 6, 5, 8, 11, 15, 2
Seminars	15	0.6	12, 14, 13, 1, 6, 5, 4, 3, 7, 8, 9, 10, 11, 15, 2
Theoretical sessions	25	1	12, 14, 1, 6, 8, 9, 2
Type: Supervised			
Tutorials	2	0.08	12, 6, 5, 4, 3, 7, 11, 15
Type: Autonomous			
Personal study	60	2.4	14, 6, 5, 4, 8, 9, 2

## 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) Two works 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.

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 retake process, 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.

## Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Practical excercises	10%	0	0	12, 14, 13, 1, 6, 5, 4, 3, 8, 9, 2
Seminar reports	30%	0	0	12, 14, 13, 1, 6, 5, 4, 3, 7, 8, 9, 10, 11, 15, 2
Written test I	30%	1.5	0.06	12, 14, 6, 5, 4, 3, 8, 9, 2
Written test II	30%	1.5	0.06	12, 14, 6, 5, 4, 3, 8, 9, 2

## 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.

Principles of cancer genetics. Edited by: F. Bunz. Baltimore: Springer. 2016. 2nd edition.

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 available on virtual campus