UAB
Universitat Autònoma de Barcelona

Molecular and Cell Biology of Cancer

Code: 101897
ECTS Credits: 6

2025/2026

Degree	Type	Year
Biomedical Sciences	OT	4

Contact

Name: Ana Paula Candiota Silveira

Email: anapaula.candiota@uab.cat

Teachers

Asier Gonzalez Sevine

Teaching groups languages

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

Prerequisites

No specific requirements. Still, it is advisable that exchange students have successfully completed at least 2 full academic years at their originating institution. Most reference literature is in the English language, which is also used in the figures projected in theory and problems classes and in the laboratory teaching.

Objectives and Contextualisation

- Describe the main differential characteristics of tumor tissue compared to normal tissue, as well as the cellular and molecular bases of these differences.
- Describe the deregulation of basic properties of normal tissues, such as cell proliferation and controlled cell death processes, and its effect on tumor progression, whether through genetic mechanisms (e.g., mutations) or epigenetic mechanisms (e.g., angiogenesis, changes in the tumor microenvironment, deregulation of extracellular proteolysis).
- Understand the cancer immune cycle
- Introduction to the molecular bases of some recently described antitumor strategies.

Competences

- Display knowledge of the basic life processes on several levels of organisation: molecular, cellular, tissues, organs, individual and populations.
- Display theoretical and practical knowledge of the major molecular and cellular bases of human and animal pathologies.

- Read and critically analyse original and review papers on biomedical issues and assess and choose the appropriate methodological descriptions for biomedical laboratory research work.
- Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.

Learning Outcomes

1. Analyse the molecular mechanisms that regulate the size and differentiation stage of cells in tissues.
2. Critically analyse the experimental parameters measurable in tissues in a normal or pathological physiological situation, as described in the relevant scientific literature.
3. Describe the mechanisms of cell signalling and communication.
4. Explain the regulation of the cell cycle and its modulation.
5. Identify the mechanisms that regulate gene expression in cells, and their importance in the different cell functions.
6. Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.
7. Write a review paper in the area of molecular and cell biology.

Content

Chapter list

Chapter 1. The nature of cancer. Types of tumours. Clonal selection and tumour progression. Driver, passenger and neutral mutations. Hallmarks of cancer: required competences for cells to become tumoral. Viruses, mutations and cancer.

Chapter 2. Oncogenes. Mechanisms for the activation of oncogenes. Oncogens and Proto-oncogens. What are oncogens: growth factors, receptors, transductors, transcription factors.

Chapter 3. Tumour suppressor genes (TSG). General features. The Knudson hypothesis. Examples of TSG: Rb, NF1, APC, VHL, p53.

Chapter 4. Loss of cell cycle control and genomic instability. Tumour cells are independent of pro-proliferation signalling and growth suppressors: myc, pRB, E2F and restriction point control. Tumour cells are (need to be) genomically unstable: Darwinian evolution in cancer. Surveillance mechanisms: critical barriers in malignant transformation.

Chapter 5. Genomics and transcriptomics of cancer. Role of DNA lesions, types of mutagens and their activation path, surveillance mechanisms and repair pathways. Epigenetics aspects of malignant transformation, promotors. Non-coding RNAs and cancer. Role of massive genome sequencing and of tumoral transcriptomics in the understanding of tumour progression.

Chapter 6. Stem cells and deregulation of cell death. Tumour stem cells or tumour initiating cells, hierarchy and niches, differentiation. Senescence, telomerase and inmortalization. Apoptosis and Necrosis.

Chapter 7. Tumour progression. Stages in progression. Hypoxia and angiogénesis. Reprogramming of tumour metabolism. Role of tumour microenvironment, pHe, inflammation, heterotypic interactions in tumours. Molecular basis of invasion, directional migration and metastasis.

Chapter 8. Molecular basis of new antitumour therapies. Classical therapies. The resistance problem. The problem of adequate models. The problem of biomarkers of response. Rational drug design. Anti-angiogenic therapy. Immunotherapy. Oncolitic viruses. Re-differentiation therapy. Therapy against tumour initiating cells.

Laboratory work. Three sessions for each lab group. Lab work with cultured tumour cell lines. Response and resistance to therapy.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory work	12	0.48	2, 6
Problems based teaching	13	0.52	2, 6
Theory classes	26	1.04	3, 4, 1, 5
Type: Supervised			
Homework delivery	4	0.16	2, 4, 1, 5
Tutor supervision	4	0.16	4, 1, 5
Type: Autonomous			
Information retrieval, study, processing of gathered information and electronic delivery of supervised homework through "Campus Virtual"	44	1.76	2, 7, 4, 6
Problems solving	10	0.4	2, 6
Studying for exams	16	0.64	4, 1, 5
Writing the laboratory work report	8	0.32	2, 4

Theory
Lectures with an emphasis on student participation and learning, fostering discussion and engagement. Historical aspects will be discussed to understand the evolution of cancer molecular biology, and current topics will also be addressed.

Problem-solving classes
Problem-solving, interpretation of scientific article results, and reflections on practical and experimental topics. Questions and topics to be answered and/or presented by students will be proposed, which also forms part of continuous assessment.

Laboratory Work
Laboratory sessions will be conducted with cell cultures, exploring aspects of in vitro chemotherapy and treatment resistance. They will be carried out in groups of 2-3 people, followed by a report submission. Lab manuals will be made available in advance on the course's virtual campus.

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

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Delivering the laboratory work report	10%	1	0.04	2, 7, 6
Homework delivery, problems evaluation	40%	6	0.24	2, 7, 4, 1, 6
Partial exams	50%	6	0.24	2, 3, 4, 1, 5

- This course does not foresee a single evaluation system.
- Any valuable participation conducted in English will have a maximum multiplier factor of 1.1 and a minimum of 1.
- Assessment: Delivery of written assignments, 40% of the total grade; laboratory work report, 10% of the total; written midterm exams, 50% of the total. Total course grade: 100%. A passing grade is 5 out of 10.

- Exams: A first midterm exam, approximately after Topic 4, and a second midterm after Topic 8. The final written exam grade will be the weighted average of the two midterms according to their relative weight (the first midterm counts for 1/3 and the second for 2/3) and will provide an "exam grade" for the course. Exams will be open-book, allowing access to notes, computers, and the internet.

- Work through the course: There will be 4 written assignments per course. Assignments may include problem-solving, data interpretation, literature research, video preparation, etc., as proposed by each teacher via the course platform's assignment submission tool. Each assignment will contribute 10% (total: 40%).

- Grade Review: After each written exam, there will be a designated day and time slot for grade review, announced on the Virtual Campus at least 48 hours in advance. Students must confirm by email their intention to attend the exam review.

- Students who cannot attend an individual assessment due to a justified reason (such asillness, death of a first-degree relative, or an accident) and provide official documentation to the Degree Coordination will be entitled to take the assessment on another date. The Degree Coordinator will arrange this with the instructor of the affected course.

- Description of the Retake Process:

  For grades obtained in retake activities to be considered for final grades, students must have been assessed in a set of standard activities equivalent to at least two-thirds of the total course grade. Thus, a student will receive a "Not Evaluable" grade if the sum of the maximum grades of all standard assessable activities (before retakes) is less than 67% of the total course grade. Any grade obtained in retake activities will replace the grade from the corresponding standard activity, regardless of whether the original grade was higher or lower. Retake activities will apply to standard assessments equivalent to at least 50% of the total course grade. Therefore, the parts of the course affected by the retake process will be the grades for Exams 1 and 2 (50% of the total grade). The practicals, assignments, and problem-solving components are not eligible for retakes. During retake activities, access to all course materials, including the internet, will be permitted.

  To avoid unnecessary printing of assessment materials or reserving spaces for retake activities that may not be needed, students interested in retakes must communicate their intention to attend at least 48 hours before the scheduled retake via the Virtual Campus. Only students who have given such notice will be admitted to the retake activity. If no students request to participate, the retake will be canceled.

Bibliography

Reference books available from ARE UAB or local library loan:

1. The Biology of Cancer. Robert A. Weinberg, 3d Edition, 2023, Norton and Company, Inc, NY, USA. (Es l'edició més nova, pero la disponible a la biblioteca és l'anterior)

Library loan: Ciència i Tecnologia, code 616-006 Wei (exemplar 2014, 2nd edition)

2. Molecular and Cell Biology of Cancer. Rita Fior, Rita Zilhão Editors, 2019, Springer, eBook

https://bibcercador.uab.cat/view/action/uresolver.do?operation=resolveService&package_service_id=886494228

3. Molecular Cell Biology. Harvey Lodish et al. 9th Edition, 2021, McMillan learning.

https://bibcercador.uab.cat/view/action/uresolver.do?operation=resolveService&package_service_id=886494224

4. Molecular Biology of the Cell. Bruce Alberts et al. 7th Edition, 2022, W.E. Norton and Company.

Library loan: Ciència i Tecnologia library, code 576 Alb

Software

There is no specific software associated with this subject.

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	341	English	second semester	morning-mixed
(PLAB) Practical laboratories	341	English	second semester	afternoon
(PLAB) Practical laboratories	342	English	second semester	afternoon
(TE) Theory	34	English	second semester	morning-mixed