

Degree programme	Type	Course
Biochemistry	OP	4

Contact lecturer

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Teaching staff

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Group languages

You can consult this information at the [end](#) of the 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

- 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.

Learning outcomes

- CM16 (Assess new methodologies and approaches in molecular biology research applied to the study of cancer.) Assess new methodologies and approaches in molecular biology research applied to the study of cancer.
- CM17 (Design experiments using molecular biology techniques to address complex problems in the field of biochemistry.) Design experiments using molecular biology techniques to address complex problems in the field of biochemistry.
- CM18 (Make an oral presentation on a topic related to molecular biology.) Make an oral presentation on a topic related to molecular biology.

- KM23 (Describe the molecular foundations of cancer.) Describe the molecular foundations of cancer.
- SM18 (Apply computing resources to visualize and understand the three-dimensional structure of proteins, search for information in databases, and use molecular tools.) Apply computing resources to visualize and understand the three-dimensional structure of proteins, search for information in databases, and use molecular tools.
- SM19 (Analyse the molecular mechanisms that regulate the function of proteins and nucleic acids, as well as their alterations in cancer.) Analyse the molecular mechanisms that regulate the function of proteins and nucleic acids, as well as their alterations in cancer.

Contents

Chapter list

Chapter 1. The nature of cancer. Clonal selection and tumour progression. Monoclonal vs. polyclonal origin. Driver, passenger and neutral mutations. Hallmarks of cancer: required competences for cells to become tumoral.

Chapter 2. Oncogenes, viruses and cancer. Mechanisms for the activation of oncogenes. Oncogenes and proto-oncogenes: growth factors, receptors, signal transducers (e.g., Ras and PI3K-AKT-mTOR pathways) and transcription factors.

Chapter 3. Tumour suppressor genes (TSGs). General features. The Knudson hypothesis and haploinsufficiency. Role of DNA methylation in TSG inactivation. Examples of TSGs: 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, promoters. 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 immortalization. Apoptosis and Necrosis.

Chapter 7. Tumour progression. Stages in progression. Hypoxia and angiogenesis. Reprogramming of tumour metabolism. Role of tumour microenvironment, pH, 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. Oncolytic 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.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Tutor supervision	4	0.16	KM23, SM18, SM19
Writing the laboratory work report	8	0.32	CM16, CM17, SM18
Homework delivery	4	0.16	CM16, KM23, SM19
Problems based teaching	13	0.52	CM18, KM23, SM19
Laboratory work	12	0.48	CM16, CM17
Solving problems	10	0.4	CM18, SM18
Studying for exams	16	0.64	CM16, KM23, SM19
Information retrieval, study, processing of gathered information and electronic delivery of supervised homework through "Campus Virtual"	44	1.76	CM16, CM18, KM23, SM18, SM19
Theory classes	26	1.04	KM23, SM19

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 attendance is mandatory. 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

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes
Partial exams	50%	6	0.24	KM23, SM19
Homework delivery, problems evaluation	40%	6	0.24	CM17, CM18, KM23, SM18
Delivery of the laboratory work report	10%	1	0.04	CM16, CM17

- This course does not foresee a single evaluation system.
- All evaluable activities must be performed in English
- 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 personal class-written notes, but laptops, internet or informatic tools will not be allowed.
- 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 as illness, 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. Retake activities will be open-book, allowing access to personal class-written notes, but laptops, internet or informatic tools will not be allowed.
- Students opting for grade improvement in the retake process are discarded for "highest honours" (Matrícula d'Honor) assignment.
- 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.

For this course, the use of Artificial Intelligence (AI) technologies is allowed exclusively for support tasks, such as literature searches, information retrieval, text correction, or translations. Students must clearly identify which parts have been generated using these technologies, specify the tools used, and include a critical reflection on how these have influenced the process and final outcome. Lack of transparency in the use of AI in this assessed activity will be considered a breach of academic integrity and may result in partial or total penalties in the grade, or more severe sanctions in serious cases.

The commission of any irregularity in an assessment activity (academic fraud, plagiarism, or improper use of AI, unless such use is explicitly authorized in the course guide) that may lead to a significant alteration of the grade will result in that assessment activity being awarded a grade of **0 (zero)**. If the course guide establishes that obtaining a minimum grade in that assessment activity 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 (zero)**. Furthermore, independently of these academic consequences, disciplinary proceedings may be initiated against any student who commits any of these irregularities.

Bibliography

Reference books available at ARE UAB environment o library loan:

1. The Biology of Cancer. Robert A. Weinberg, 3d Edition, 2023, Norton and Company, Inc, NY, USA.

https://bibcercador.uab.cat/permalink/34CSUC_UAB/1fbc57r/alma991010876635806709

2. The Biology of Cancer. Robert A. Weinberg, 2nd Edition, 2014, New York: Garland Science.

https://bibcercador.uab.cat/permalink/34CSUC_UAB/tidafd/alma991003944119706709

3. 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

4. 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

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

Prèstec físic: Exemplar a Ciència i Tecnologia, localitzador 576 Alb

Software

There is no specific software associated with this subject.

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

Type of teaching	Group	Language	Semester	Shift
(TE) Theory	34	English	second semester	morning-mixed
(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