Universitat Autònoma de Barcelona

2018/2019

Molecular and Cell Biology of Cancer

Code: 101897
ECTS Credits: 6

Degree	Type	Year	Semester
2501230 Biomedical Sciences	OT	4	0

Contact

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Use of languages

Principal working language: english (eng)
Some groups entirely in English: Yes
Some groups entirely in Catalan: No
Some groups entirely in Spanish: No

Other comments on languages

Instructors can interact with students in Catalan, Spanish or English. All contributions submitted for evaluation in English language will produce a bonus. Bonus will multiply the numerical grade obtained by a factor between 1 (minimum) and 1.1 (maximum)

Teachers

Anna Maria Bassols Teixidó

David Garcia Quintana

Prerequisites

No specific requirements. Still, it is advisable that exchange students have succesfully completed already 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. Furthermore, oral communication in English will be used when the student addresses the teacher in this language.

Objectives and Contextualisation

The hallmarks of cancer with respect to normal tissues and the molecular and cellular basis of those differences will be described. The relevance of deregulation of basal properties of tissues, such as cellular proliferation or controlled death processes will be emphasized. Their effects in tumour progression, be it through genetic (i.e. mutations) or epigenetic changes (i.e. angiogenesis, tumour microenvironment, extracellular proteolysis deregulation) will be considered. Finally, the molecular basis of new therapies will be analysed.

Skills

- 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 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.
- 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.
- 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. Contribute to public discussions on cultural matters.
3. Critically analyse the experimental parameters measurable in tissues in a normal or pathological physiological situation, as described in the relevant scientific literature.
4. Describe the mechanisms of cell signalling and communication.
5. Develop critical thinking and reasoning and communicate ideas effectively, both in the mother tongue and in other languages.
6. Develop independent learning habits and motivation to continue training at postgraduate level.
7. Develop independent learning strategies.
8. Develop scientific knowledge, critical reasoning and creativity.
9. Explain the regulation of the cell cycle and its modulation.
10. Generate innovative and competitive proposals for research and professional activities.
11. Identify and understand the advances and challenges of research.
12. Identify the mechanisms that regulate gene expression in cells, and their importance in the different cell functions.
13. Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.
14. 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. Oncogens. 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.

Methodology

Theory and guided problem-solving classes. Emphasis will be placed in the learning performance of students. Such learning performance will be actively fostered by teachers by providing gradings for the homework and problem solving tasks performed by students (see evaluation strategy section). Laboratory work (3 sessions) will be performed in 2-3 people groups.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Laboratory work	12	0.48	3, 8, 7, 5, 13
Problems based teaching	13	0.52	3, 8, 7, 5, 13
Theory classes	26	1.04	4, 9, 1, 12, 11
Type: Supervised			
Homework delivery and associated interaction through "Campus Virtual"	14	0.56	
Tutor supervision	2	0.08	
Type: Autonomous			
Information retrieval, study, processing of gathered information and electronic delivery of supervised homework through "Campus Virtual"	46.5	1.86	3, 8, 7, 6, 5, 14, 13
Problems solving	10	0.4	3, 8, 7, 5, 13
Studying for exams	10	0.4	7, 6
Writing the laboratory work report	6	0.24	5

Evaluation

- All contributions submitted for evaluation in English language will produce a bonus. This bonus will multiply the numerical grade obtained by a factor between 1 (minimum) and 1.1 (maximum).

- The percentage contribution to the global evaluation will be: 51% supervised participative homework (about three items) and problem solving (one item) evaluation, 10% Laboratory work evaluation and delivery of the lab work report, 39 % partial exams (two of them). Pass grade is with 5 out of 10.

- Exams: There will be two partial exams. The first partial will be after chapter 4, and the second one, after chapter 8. Final exam grade will be the weighed average of the two partial exam grades (first partial weighs 1/3 and second partial weighs 2/3).The written exam for the second partial will contain short questions and/or problems to solve, with unlimited offline access to course related information, books, class notes, PC (except Internet access).

- Continuous work performance evaluation. There will be 2-3 homework reports to be delivered during the course. Such homework may be of the type of: problem solving, publication data interpretation, literature search, seminar delivery, etc. Every teacher in charge will propose the homework subject through the "Campus Virtual" interactive tools. In case written deliveries are requested, both electronic and printed submission within the allocated time frame will be mandatory. Homework may be individual or in small groups, according to the teacher instructions in each instance.

- Revision of grades. A revision date and time frame will be announced after each written partial exam. Furthermore, grades for other course work will appear periodically all along the course at the "Campus Virtual". There will be at least 3 time frames for revision offered during the course. Day and time frame for grade revision will be duly advertised at "Campus Virtual" at least 48 hours prior to the starting revision time, and also atclass time.

- As for the grading strategy, all homework and supervised work handed in for evaluation will be considered individual items contributing the global evaluation section of the course (51% of the total grading).

- Students not able to attend an evaluation exam due to relevant conditions (illness, family death, accident) and deliver valid proof of such condition to the teacher/degree Coordinator, will be allowed to perform the missing evaluation at a different date. The degree coordinator will oversee this in case of need to secure an adequate date for performing the additional evaluation.

- To be able to attend the laboratory work sessions the student should provide proof of successful evaluation of lab security and biosecurity conditions available through "Campus Virtual". Furthermore, he/she should be aware and accept the rules for access and work at the laboratories of the Faculty of Biosciences.

- Retake process description. To be eventually eligible for the application of the retake process for final grading, the student should have been evaluated in a set of activities equal at least two thirds of the final score of the course or module. Thus, the student will be graded as "No Avaluable" (Not Assessable) if the weighing of all conducted evaluation activities, before application of the retake evaluation derived grades, is less than 67% of the final score. Any grade obtained in the activities identified as "retake activities" will substitute the grade obtained in the previous activity that the retake activity is substituting, independently of the previous grade being lower or higher than the retake grade. The retake sessions will be applied to grade producing activities equivalent at least to 50% of the final score. The specific items involved in the retake process will be detailed at the course start.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Delivering the laboratory work report	10%	0.5	0.02	3, 8, 7, 5, 14, 13
Homework delivery, problems evaluation and associated interaction through "Campus Virtual"	51%	6	0.24	3, 8, 7, 6, 5, 14, 9, 10, 1,

				11, 13
Partial exams	39%	4	0.16	3, 2, 4, 5, 9, 1, 12, 11

Bibliography

Reference books

1. The Biology of Cancer, 2nd Edition. Robert A. Weinberg, 2014, Garland Science, NY, USA.

2. Molecular Cell Biology. Harvey Lodish et al. 7th Edition, 2012, Freeman and Co., NY, USA.

3. Molecular Biology of the Cell. Bruce Alberts et al. 5th Edition, 2008, Garland Science, NY, USA