

Master's Degree in Molecular Biology of Cancer

Course Teaching Guide – Molecular Oncology and Cancer Treatment

Basic data of the subject

Subject:	Molecular oncology and cancer treatment			
Type:	Mandatory			
ECTS credits:	7			
Semester:	1st and 2nd			
Involved departments:	Biochemistry and Molecular Biology			
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Specific course information

Course description:	<p>In this subject, the specific molecular characteristics and the main therapeutic approaches used in the main types of solid tumours, as well as leukaemias and lymphomas will be studied. Specifically, the following will be studied:</p> <ul style="list-style-type: none"> • The molecular characteristics of some of the most common tumor types; its classification and the main therapeutic approaches used in its management: <ul style="list-style-type: none"> ○ breast, lung, or prostate cancer; ○ tumors of the central nervous system such as glioblastoma, gliomas, neuroblastomas; ○ sarcomas, head and neck carcinomas and pancreatic adenocarcinomas; ○ leukemias, lymphomas and myelomas, • The main innovative therapeutic approaches used in the treatment of cancer include targeted therapies, immunotherapy, CAR-T cells, state-of-the-art radiotherapies, etc.
Requirements:	None
Recommendations:	None

Learning Outcomes

Knowledge and content	<ul style="list-style-type: none"> • To know the basic molecular and cellular mechanisms whose dysregulation leads to the development of cancer, with special emphasis on oncogenic and tumour-suppressing mechanisms. • To know the molecular and cellular mechanisms involved in the reciprocal interactions that occur between the tumour and the tumour microenvironment and how they affect tumour progression.
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	<ul style="list-style-type: none"> • To know the main genetic and environmental risk factors that predispose to the development of cancer, as well as the main molecular mechanisms responsible for the effects of these factors. • To know the similarities and differences at the molecular level between the main types of solid and haematological tumours, as well as their impact on the evolution of the disease, its diagnosis and treatment. • To learn about the main types of anti-tumour treatments with special attention to the use of advanced techniques of radiotherapy, cell therapy, immunotherapy, nanoencapsulation and targeted therapies. • To know the main methods of diagnosis in cancer, both general and specific to each type of tumour, with special attention to molecular diagnostic methods, which allow the identification of specific genetic alterations, as well as the use of early detection techniques by liquid biopsy. • To know the main stages involved in the process that allows, based on basic research and preclinical models, to intellectually protect, validate, and, where appropriate, use and market, new biomarkers useful in the diagnosis or prognosis of cancer, new chemical, biological or physical agents, or new pharmaceutical preparations with anti-tumour activity or that alleviate the symptoms of cancer patients.
Skills and abilities	<ul style="list-style-type: none"> • Ability to understand and apply concepts, tools, and methodologies in cancer research that allows them to develop an integrative vision of advances in scientific research in this field • Ability to analyze and understand a scientific work from the hypothesis and the initial objective, preliminary approach to the conclusions obtained. • Ability to clearly and unambiguously express results from scientific research in the field of molecular biology of cancer in a clear and unambiguous report or scientific work in English. • Ability to communicate the conclusions obtained from scientific works to specialized and non-specialized audiences in a clear and unambiguous way: developing, understanding, and transmitting knowledge, scientific results, and strategies, in English. • Ability to use and appropriately apply the latest techniques for the analysis of the mechanisms underlying tumor development and progression, as well as to study the mechanism of action of antitumor treatments in cultured cells, tissues, or whole organisms. • Ability to develop principles based on the knowledge acquired that allow the selection or design of appropriate anti-tumour therapies for each type and stage of cancer in a personalised way (for each patient). • Ability to understand, and eventually manage, the legislative, social, health, and ethical implications of basic, translational, and clinical research in oncology. • Ability to learn autonomously and carry out critical analyses that allow the attendees to evolve professionally in a self-directed way.
Competencies	<ul style="list-style-type: none"> • Understand the molecular, cellular and pathophysiological bases of cancer that allows them to continue studying in the field of molecular biology of cancer in an autonomous or self-directed way. • To design experimental approaches that allow the analysis of the molecular, cellular or pathophysiological mechanisms involved in the development and progression of cancer, as well as to evaluate the efficacy of new diagnostic methods or new therapeutic approaches. • Interpret results derived from the application of diagnostic methods or reports generated by oncology professionals for the diagnosis and classification of cancer. • Assess the social and ethical responsibilities and environmental risks involved in their professional practice. • Prepare basic documents in the appropriate format that serve as a basis for the filing of patents, as well as clinical trials, in the area of oncology. • Apply the principles of the scientific method, understanding its value and limits, and incorporating the ethical principles that govern professional practice. • Develop an adequate capacity for communication and dissemination of professional activity, both among specialists and in front of the less specialised audiences. • Be able, based on the knowledge acquired in the field of molecular biology of cancer, to evaluate and select the appropriate scientific information to formulate judgments and interpretations from limited information. • Understand and recognize the need for continuous training and study in the field of oncology for the performance of their professional activity.

Objectives

1. To integrate the molecular biology of cancer into a clinical vision of the cancer patient, connecting cellular mechanisms with the evolution of the disease.

2. To interpret tumor heterogeneity, its interaction with the microenvironment, and its impact on diagnosis, prognosis, and therapeutic response.
3. Apply molecular reasoning to decision-making in oncology, critically evaluating current diagnostic and therapeutic strategies.
4. Understand the process of knowledge transfer in oncology, from basic research to its clinical and pharmaceutical application.

Methodology

Description:

The teaching activity will follow a combined methodology, which will make use of collaborative learning and individual learning. The face-to-face activities are structured in theory classes, exhibitions or seminars and tutorials.

In the **theoretical classes**, the student acquires knowledge through master classes given by the professor and, eventually, by guest speakers who are specialists in a specific aspect of the subject program. In this type of class, the teacher will inform the student of the content of the subject. The theoretical concepts and some experimental data will be presented that allow the student to obtain a global and comprehensive vision of the subject. At the beginning of each topic, the content and main objectives of that topic will be presented. At the end of the topic, new proposals may be made that allow the interrelation of content already studied with that of the rest of the subject or with other subjects. To support the theoretical explanations, students will be provided with the appropriate teaching material (slides, videos, applications, etc.) through the Virtual Campus.

In the **exhibition or seminar classes**, students will make an exhibition of research works related to the subject program. These classes dedicated to exhibitions/seminars aim to apply the knowledge acquired to the discussion, for example, of scientific research articles that will be presented by the students and then critically debated by them and the professors. This type of seminar may also derive from visits or "fieldwork" of the students to research groups and other types of entities of interest for the objectives of the Master's Degree.

Tutorials, which will try to delve into specific aspects of the syllabus to facilitate learning.

Assessment: Oral or written tests to assess learning outcomes.

Autonomous work: The student's personal work is an essential part of the learning process, including studying, solving exercises and preparing individual or group work and reports. Other individual work of the student includes reading bibliographic material provided by the professor, preparing for exams, etc.

		Hours	% face-to-face attendance
Distribution of teaching activities	Theoretical classes:	35	100
	Presentations and/or seminars:	13	100
	Tutorials	6	100
	Evaluation:	2	100
	Face-to-face work:	56	100
	Self-employment:	119	0
	Total:	175	

Evaluation

Applicable criteria:

The evaluation of students combines: (a) the completion of a final exam (60% of the overall grade of the subject) with (b) continuous evaluation, defined by the student's work in classes, assignments, presentations, midterm exams, practices and other complementary training activities (20% of the overall grade of the subject), and (c) the presentation and discussion in class of research works (20% of the overall grade of the subject). Students must actively and responsibly participate in at least 70% of face-to-face training activities. The grades will be based on the absolute score of 0 to 10 points in accordance with the scale established in RD 1125/2003.

Semester organization

The subject will be taught in the first semester and in the first weeks of the second semester.

Syllabus

Theoretical program:

Solid tumors

1. Introduction to solid tumors: Importance of molecular characterization
2. Sporadic breast cancer

	<ol style="list-style-type: none"> 3. Prostate cancer 4. Colon cancer 5. Lung cancer 6. Hepatocellular Carcinoma and cholangiocarcinoma 7. Ovarian cancer 8. Gliomas 9. Squamous Cell Carcinoma and Head and Neck cancer 10. Melanoma (and other skin cancers) 11. Sarcomas and other less frequent tumors 12. Bladder cancer 13. Pancreatic cancer 14. Classical treatments in oncology 15. New therapeutic approaches in solid tumors <p><u>Haemato-oncological diseases</u></p> <ol style="list-style-type: none"> 16. Introduction to liquid tumors: Importance of molecular characterization: oncogenes, rearrangements, chip mutations, clonal evolution, microenvironment and infections 17. Myeloid tumors 18. Lymphoid tumors 19. Treatments for hematological diseases: transplantation, chemotherapy, targeted treatments and immunotherapy, including CAR-T treatment. Mechanism of resistance 20. New therapeutic approaches in haemato-oncology
<p>Seminars:</p>	<p>Clinical cases and examples of clinical trials, seminars and workshops related to novel therapeutic approaches in solid tumors</p> <p>Clinical Seminars: Classification of Hemato-oncological Tumors / Clinical Management of Haemato-Oncological Patients</p>
<p>Bibliography:</p>	<p>Pecorino, L. (2020). Molecular biology of cancer: Mechanisms, targets, and therapeutics (4th ed.). Oxford University Press.</p> <p>DeVita, V. T., Lawrence, T. S., & Rosenberg, S. A. (Eds.). (2020). Cancer: Principles & practice of oncology – Primer of the molecular biology of cancer (11th ed.). Wolters Kluwer.</p> <p>MacLeod, R. A. F., & Mullighan, C. G. (Eds.). (2019). Molecular oncology. Cambridge University Press.</p> <p>Cree, I. A. (Ed.). (2016). Molecular oncology testing for solid tumors: A pragmatic approach. Springer.</p> <p>Armitage, J. O., Longo, D. L., & Abeloff, M. D. (Eds.). (2018). Hematologic malignancies. Springer.</p> <p>Hoffbrand, A. V., Moss, P. A. H., & Pettit, J. E. (2016). Essential haematology (7th ed.). Wiley-Blackwell.</p> <p>Larson, R. A., & Tallman, M. S. (Eds.). (2020). Hematologic malignancies: Molecular pathogenesis and targeted therapy. Springer.</p>