



UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Biochimica dei Tumori

2627-1-F0803Q063

Aims

The course will present an overview of cancer development processes at the biochemical and molecular level, outlining the mechanisms of carcinogenesis induced by physical, chemical and viral agents. The main biochemical pathways of normal tissues involved in carcinogenesis will also be presented, including the regulatory networks involved in growth control and cell death. Along the course, cellular and molecular techniques will also be presented for the study of cancer progression, treatment and prevention.

Knowledge and understanding.

At the end of the course the student will have to know the bases of the human tumorigenesis process, the biochemical and molecular mechanisms deregulated in the same process and the experimental methods mostly used for the study of tumors both in vitro and in vivo; furthermore he will have knowledge of the molecular targets of current cancer therapies and the effect of external agents on the tumorigenesis.

Ability to apply knowledge and understanding.

The student will need to be able to use what they have learned to recognize the molecular and cellular characteristics of different types of tumors and tumor cells, in order to apply this knowledge critically and identify the most rigorous experimental approach to address questions arising from both basic and applied research. This autonomy will be fostered throughout the course through the teacher's promotion of classroom discussions and interactive methods aimed at synthesizing the various topics covered in the lectures in an educative manner.

Communication skills.

At the end of the course the student will be able to express appropriately the topics of the course, with language properties and ability in the oral exposition in order to find a collocation both in the field of basic research and applied research (medical or pharmaceutical).

Learning skills

At the end of the course the student will be able to read and analyze the literature on the topics covered during the course and will be able to integrate and connect the knowledge acquired with what will be learned in other courses related to cellular and molecular biology or pharmacological.

Contents

The nature of the cancer
Oncogenic Viruses
Oncogenes
Signal transduction and transformation
Cytoplasmic pathways control many aspects of tumors Tumor Suppressors
Rb and the cell cycle
p53 and the control of apoptosis Immortalization and telomere
Tumor progression as a multi-phase process Genomic integrity and cancer
The metabolism of tumors
Therapy in tumors

Detailed program

Nature of Tumors: histology and classification of tumors, role of the environment in tumor onset
Oncogenic viruses: oncogenic viruses (retroviruses and DNA viruses), viral oncogenes
Oncogenes: proto-oncogene, Src, Ras, EGFR and Myc
Signal transduction and transformation: the role of proto-oncogene in transformation, receptor and cytoplasmic tyrosin kinases, constitutive activation of signal transduction pathways in tumors
Cytoplasmic pathways control many aspects of tumors: the role of the mitogenic signal in tumors, the Ras pathway as a cell transformation mechanism, MAPK, PI3K, Ral, the oncogenic pathways: integrins, Wnt, NFkB, Notch, Hedgehog, TGFb, Protein G
Tumor Suppressors: definition of tumor suppressor, Retinoblastoma as tumor model, silencing mechanisms of tumor suppressors, NF1, Apc, VHL
Rb and the cell cycle: physiological and pathological mechanisms of cell cycle control in mammals, association between mitogenic signal and cell cycle, cyclins, cyclin-dependent kinase, cycle inhibitors, Retinoblastoma in control of mitotic checkpoint, E2F family, Retinoblastoma and cell differentiation
p53 and the control of apoptosis: p53 and its role in the apoptotic process, intrinsic and extrinsic apoptosis, necrosis
Immortalization and telomere: mechanisms involved in cellular and tissue senescence, senescence and telomere, telomere and transformation
Tumor progression as a multiphase process: temporal dynamics of tumor development, stem cancer cells, oncogenic mutations cooperate for cell transformation, mutagenic agents and promoters, inflammation and tumors
Genomic integrity and cancer: alteration of DNA repair mechanisms as a mutagenic agent, exogenous mutagenic agents, repair mechanisms and protection
Tumor metabolism: role of metabolic alterations in tumorigenesis, Warburg effect, mitochondrial dysfunction and role of mitochondria in transformation, role of glutamine in the control of proliferation and cell cycle, alteration of the hexosamine pathway, tumor metabolism as therapeutic target
Tumor therapy: radiotherapy, chemotherapy, drug resistance, examples of drugs, in vitro and in vivo tests, clinical trials

Prerequisites

The course is highly recommended to any graduate of biotechnology and biology as well as to medical student interested in reviewing the fundamentals of cancer biochemistry. The main prerequisites are the knowledge in

Cellular biochemistry and molecular biology. However during the course also these fields will be well explained.
Prerequisites. None

Teaching form

18 lectures of 2 hours each will be delivered in person in a traditional lecture-based format.

3 lectures of 2 hours each will be delivered in person in an interactive format. One lecture will be given by an external guest speaker with expertise in the mechanisms underlying oncogenesis and/or cancer therapy and/or innovative approaches to the study of oncogenesis.

Two lectures will involve the presentation and discussion of a scientific article selected by the course teacher. The class will be divided into two groups; each group will present the article through an oral presentation and then discuss it with the rest of the students. The interactive lectures will be organized in the final part of the course.

The course will be taught in Italian.

Textbook and teaching resource

Slides of the lessons and the book.

"The Biology of the cancer", di R. Weinberg seconda Edizione.

"Molecular Biology of the Cell", Alberts ultima edizione.

"Becker's World of the Cell", Hardin and Bertoni

All teaching materials related to the course (slides) will be made available on the course's e-learning page. Recordings of the course from previous academic years will also be available on the e-learning site.

Semester

First semester

Assessment method

The examination consists of a mid-term written test and a final oral examination.

The mid-term test will take place halfway through the course and will consist of a written test composed of three open-ended questions related to the first part of the programme. The aim of this test is to assess the student's knowledge of the topics covered, as well as their ability to understand, integrate and apply them to the molecular and cellular mechanisms underlying the process of carcinogenesis.

The mid-term test will be graded with a mark out of thirty and does not constitute a prerequisite for admission to the final oral examination. The student may decide whether to accept the mark obtained in the mid-term test, which will be averaged with the mark obtained in the final oral examination, or not to accept it. In the latter case, the final oral

examination will cover the entire course programme. The student is also free not to take the mid-term test and to sit directly for the final oral examination, in which they will be assessed on all the topics of the programme.

The final oral examination will take place at the end of the course. For students who have accepted the mark obtained in the mid-term test, it will cover the topics of the second part of the programme. In addition, at least one question will be asked to assess the student's ability to integrate the contents of the first and second parts of the course. For students who have not taken or accepted the mid-term test, the oral examination will cover the entire programme.

The overall assessment will take into account the student's knowledge of the contents, their ability to connect the different topics of the course, their understanding of the molecular mechanisms of carcinogenesis, the appropriate use of scientific terminology, and their ability to formulate coherent and critical answers.

The grading criteria will be as follows:

18–21/30: essential and partial knowledge, limited ability to connect the topics, simple but overall sufficient presentation.

22–24/30: fair knowledge, adequate understanding of the main concepts, and sufficiently clear presentation.

25–27/30: good command of the topics, ability to connect the course contents, and appropriate use of scientific language.

28–30/30: complete and in-depth knowledge, excellent ability to integrate the different topics, and clear, rigorous and critical presentation.

30 with honours: excellent preparation, full mastery of the contents, high degree of independent judgement, and ability to engage in critical and original discussion.

This examination format will allow students to organise their own study plan in relation to the assessment of learning for the Tumour Biochemistry course.

Office hours

Contact. On demand, by e-mail request to the professor.

Sustainable Development Goals

NO POVERTY | GOOD HEALTH AND WELL-BEING | QUALITY EDUCATION | REDUCED INEQUALITIES | SUSTAINABLE CITIES AND COMMUNITIES
