UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Biochimica dei Tumori

2526-1-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: istology 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 biochemestry. 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 two-hour lessons in lecture-based format, in-person
3 two-hour lessons in interactive, in-person
Teaching language: italian

Textbook and teaching resource

Slides of the lessons and the book "The biology of cancer" of R. Weinberg, second edition. 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

Written and oral exam divided into two parts. The first will take place during the course (midway through) and will be a written test consisting of three open questions covering the first part of the course. This test is aimed at assessing the student's ability to learn and integrate the fundamental concepts underlying the process of carcinogenesis.

The second part will be an oral exam held after the end of the course. The oral exam will evaluate topics from the second part of the course and will include a question designed to assess the student’s ability to integrate both parts of the course.
The first test, which will be graded on a scale of 30, does not act as a prerequisite for taking the second exam. The student may choose to accept the grade from the first test, which will be averaged with the grade from the second test (also out of 30), or to decline it. If the student declines the grade, they must take the second exam covering the entire course syllabus.
In any case, students are free to take only the second exam, in which they will be assessed on the full program. This examination format allows students to develop a personalized study plan for the assessment of learning in the Tumor Biochemistry course.

Office hours

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

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING | QUALITY EDUCATION