UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Tumor Biochemistry

2223-1-F0802Q063

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.
At the end of the course the student must be able to apply the knowledge acquired in point 1 to develop experimental strategies to be used in the context of oncological or pharmacological research.
Making judgments.
The student must be able to use what he has learned to recognize the molecular and cellular characteristics of different types of cancer and cancer cells in order to apply this knowledge to identify, with a critical sense, the most rigorous experimental approaches to answer the questions that come from both basic and applicative research.
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 trial

Prerequisites

The course is highly recommend to any graduate of
biotechnology and biology as well as to medical student interested in
reviewing the fundamentals of cancer biology. The main prerequisites are
the knowledge in cell biology and molecular biology. However during the

course also these fields will be well explained.
Prerequisites. None

Teaching form

Remote synchronous lessons. During the lessons will be described the information discovered about cancer in the past 30 years by using some scientific articles and a well-known text book.

Teaching language: italian.

Textbook and teaching resource

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

Semester

First semester

Assessment method

Oral examination about the whole course content

Office hours

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

Sustainable Development Goals

QUALITY EDUCATION