UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Molecular Oncology

2526-1-F0602Q125

Aims

This course aims to deepen the genetic and molecular mechanisms underlying tumorigenesis, and the principles underlying molecular oncology and tumor progression. This aim will be achieved through the critical revision of a selection of seminal publications in the field that led to the definition of basic concepts for oncology, such as those of oncogenes, tumor suppressors and cellular immortalization. We will focus on tumorigenesis as a step-by-step process, with particular attention to the role of genetic instability in tumor progression. Much of the course will be based on the critical reading of scientific publications in the field of molecular oncology. The aim of the course will be to provide the students with the critical tools and the knowledge required for a deep understanding of modern molecular oncology.

Knowledge and understanding: to convey basic knowledge in the field of molecular oncology
Applying knowledge and understanding: to teach how to evaluate critical issues related the study of molecular oncology
Making judgments: to provide guidelines on how to critically evaluate oncological studies
Communication skills: to provide guidelines for clear, concise and rational communications
Learning skills: to promote problem solving and critical thinking.

Contents

Overview of the main principles in Oncology
Oncogenes and tumor suppressors
Mechanisms of tumor suppression
Senescence and Apoptosis
Genetic instability as a hallmark of cancer
Telomeres and telomerase in cancer progression.
Stem Cells and Cancer Stem Cells
Cancer genomics

Towards personalized therapy: synthetic lethality and synthetic cytotoxicity in cancer treatment

Detailed program

Oncogenes and cellular transformation:

- overview of the main principles in oncology
- the hallmarks of cancer
- cancer is a genetic disease
- oncogenes: identification and properties
- pathways mutated in cancer
- experimental strategies in molecular oncology
- oncogenes, growth factors and receptors
- the Src, Myc and Ras oncongenes

Oncogenes and tumor suppressors on oncogenic transformation:

- oncogenes are necessary but not sufficient for cancer development
- oncogene addiction

Mechanisms of tumor suppression:

- the notion of tumor suppression
- classes of tumor suppressors
- p53 and pRb in tumor suppression
- the role of apoptosis in cancer therapy and tumor suppression
- the role of senescence in cancer therapy and tumor suppression

Genetic instability as a hallmark of cancer:

- the cellular response to DNA damage
- the DNA damage response is a tumor suppressive mechanism
- genetic analysis of components of the DNA damage response
- role of telomeres and telomerase in cancer progression
- re-activation of tumor suppressive responses in established tumors

Cancer genomics

Stem cells and cancer stem cells

Towards personalized therapy:

- the concepts of synthetic lethality and synthetic cytotoxicity
- PARP inhibitors in the treatment of tumors with specific mutations

Prerequisites

Knowledge of genetics and molecular biology

Teaching form

The course will consist of 21 two-hour in-person lectures, most of which will be structured with an initial part focused on presenting and illustrating scientific concepts and principles, followed by a second part that engages students in interpreting original scientific experiments, formulating hypotheses, and reconstructing scientific processes.
Two additional two-hour in-person sessions will be conducted in an interactive format: students will work in small groups under the instructor's guidance to prepare, present, and discuss a poster on one of the topics covered in the course.

Lectures will be supported by electronic presentations. Various issues and methodologies will be explored through appropriate examples and experiments. Original research articles will be discussed. The course will be taught in Italian.

Textbook and teaching resource

Book: Robert A. Weinberg, La biologia del cancro, Zanichelli
Robert A. Weinberg, The biology of cancer

Slides and scientific articles discussed durring the lessons is available on the e-learning page of the course.

Semester

Second semester

Assessment method

Oral exam. Interview on the topics presented during the course. In particular, students will be asked to discuss and apply the approaches and methodologies learned during the course to address the study of specific aspects in the field of molecular oncology through concrete examples and interpretation of experimental results.
This course does not include midterm exams.

Office hours

On demand by e-mail (michela.clerici@unimib.it) or after the end of the lessons.

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING