UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Nanomedicine

2526-1-F0902D003

Aims

The course aims to provide an understanding of the techniques, tools, and strategies used for the design, characterization, and validation of nanotechnologies (and nanoparticles) in the medical field, for the therapy and diagnosis of human diseases. The course is focused on understanding the development process of a (nano)drug, from the laboratory to the clinic.

Knowledge and understanding – At the end of the Nanomedicine course, students will be able to understand and integrate interdisciplinary knowledge relevant to nanobiotechnological research methodologies. They will know and understand the fields of application of nanomedicine.
Applying knowledge and understanding – By the end of the course, students should be able to use the acquired knowledge to understand the potential of nanotechnologies in the medical field.
Making judgements – Upon completion of the course, students will be able to understand the development pathway of a (nano)drug, from the laboratory to clinical application. They will be able to integrate information from different fields (biology, medicine, technology) to understand and interpret nanomedicine.
Communication skills – By the end of the course, students will have acquired appropriate scientific terminology and will be able to clearly and accurately present the topics covered.
Learning skills – At the end of the course, students will be able to critically understand and evaluate scientific literature in the field of nanomedicine.

Contents

Concepts of nanotechnology and nanomedicine. Knowledge of the main nanoparticles used in medicine and of the techniques for their synthesis, characterization and use in the biomedical field. Description of the multi-functionalization modalities of nanoparticles. Biomedical application of nanoparticles for the therapy and diagnosis of cancer and neurological and neurodegenerative diseases. How to study the pharmacokinetics and biodistribution of nanoparticles. Intracellular trafficking of nanoparticles. Biomimicry and regenerative medicine. Nanorobots and

implantable biomaterials (hydrogels).

Detailed program

Lectures:

Description of the most relevant tools used on nanoscale in medicine for drug delivery (drug delivery) and diagnostics (imaging). Nanoparticles and nano-devices. Liposomes, Solid-lipid nanoparticles, polymeric nanoparticles. Techniques for manufacturing, characterization and their applications. Targeting nanostructured materials to tissues and cells. Biomimicry. Biocompatibility. Nano-systems and strategies for the therapy and diagnosis of tumors and diseases of the Central Nervous System. Procedures for the development of classical and alternative drugs. Biosensors, nanorobots. Tissue engineering with nanodevices. Innovative applications of nanoparticles (eg hyperthermia, Cerenkov radiation). Implantable biomaterials for controlled release of drugs/nanoparticles.

Laboratory:

Preparation, functionalization, drug-loading and characterization of lipid-based nanoparticles. Critical discussion of the results from the preclinical point of view. Overview of the instrumentation useful for scientific research in the field of nanotechnology and nanomedicine.

Prerequisites

Basic knowledge of chemistry, biochemistry and biology.

Teaching form

20 h (10 lessons, 2 h each): Frontal Lesson (DE), face-to-face lessons
8 h (4 lessons of 2 h each): Frontal Lesson (DE), online lessons
4 h (2 activities of 2 h each): Interactive Lesson (DI), Exercises, face-to-face lessons
24 h (6 activities of 4 h each): Interactive Lesson (DI), Laboratory, face-to-face lessons

Textbook and teaching resource

Review and articles published in international journals will be indicated during the course.
Materials used during the frontal lessons (slides).
All material will be loaded on e-learning platform.

Suggested text books:

1. Understanding Nanomedicine - An Introductory Textbook By Rob Burgess. ISBN 9789814316385. Jenny Stanford Publishing
2. The Handbook of Nanomedicine (English Edition) 3° Edizione By Kewal K. Jain. ISBN-10 1493983547.

Humana Pr Inc

Semester

1st semester

Assessment method

Individual written examination
12 multiple-choice questions (2 marks each) on frontal lesson
1 multiple-choice questions (2 marks) on laboratory activities
1 open question (4 marks) on all the programme of the course
to be completed in 30 minutes.

The exam is positively evaluate with a score of 18/30 or higher. The questions proposed in the written exam will be constructed in such a way as to induce the student to biochemical-bio/nanotechnological reasoning, to understand the units of measurement and to be able to evaluate the skills and competences acquired according to the objectives of the course.

There are no *itinere* tests planned.

Office hours

On appointment writing to: francesca.re1@unimib.it

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING