UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Nanobiotechnology Methods

2526-2-F0901D057

Aims

The course aims to provide students with the general principles necessary to understand what information can be obtained through the main characterization techniques of nanobiomaterials, including at the single-molecule level.
Knowledge and understanding – At the end of the Nanobiotechnology Methods course, students will be able to understand the physico-chemical principles underlying the main techniques used for characterizing nanobiomaterials.
Applying knowledge and understanding – Upon completion of the Nanobiotechnology Methods course, students will be able to use the acquired knowledge to understand the potential of nanobiomaterial characterization techniques.
Judgement skills – At the end of the Nanobiotechnology Methods course, students will be able to assess the usefulness and reliability of nanobiomaterial characterization techniques.
Communication skills – By the end of the Nanobiotechnology Methods course, students will have acquired appropriate scientific terminology and will be able to present the topics covered in the course with clarity and accuracy.
Learning skills – At the end of the Nanobiotechnology Methods course, students will be able to critically understand and evaluate the scientific literature related to nanobiomaterial characterization techniques.

Contents

To learn the working principles of the most important analytical techniques and of the most relevant instrumentations used for the characterization of nanoparticles and nanomaterial of biomedical interest.

Detailed program

1) Introduction to optical techniques • Spectra of absorption and emission • Spectrophotometer and the absorption coefficient • Optical Activity (Optical Rotatory Dispersion, ORD) • Circular dichroism (CD) and optical birefringence

2) Fluorescence techniques • Fluorescence of amino acids, nucleic acids and other biomolecules • Resolved fluorescence spectrum and time-resolved • Spectrofluorimeter • Fluorophores microscopy. • Polarization and Anisotropy of fluorescence.

3) Optical microscopy techniques • Advanced Imaging Techniques • Phase contrast microscope • Fluorescence microscope • Polarizing Microscope • DIC (Differential Interference Contrast)

4) Advanced quantitative microscopy techniques • Confocal Microscopy • FRET (Fluorescence Resonance Energy Transfer) • FCS (Fluorescence Correlation Spectroscopy) • TIRF (Total Internal Reflection Fluorescence) • FRAP (Fluorescence Recovery After Photobleaching)

5) Non optical microscopy techniques • AFM (Atomic Force Microscopy) • Electron Microscope: SEM (Scanning Electron Microscopy), TEM (Transmission Electron Microscopy)

6) Nanomanipulation techniques • Magnetic Tweezers (MT) and Optical Tweezers (OT)

7) Light Scattering (LS) • Static Light Scattering (SLS) • Dynamic Light Scattering (DLS) • Z-potential

8) Other relevant analysis techniques for the nanobiotechnology • Raman Spectroscopy • SERS (Surface Enhanced Raman Spectroscopy) • SPR (Surface Plasmon Resonance) • ITC (Isothermal Calorimetry Tritration) and DSC (Differential Scanning Calorimetry) • FTIR (Fourier Transform Infrared Spectroscopy)

Prerequisites

Basic knowledge in chemistry, biochemistry and molecular biology

Teaching form

Lectures.
All lectures are conducted in person in a traditional format.
24 lectures of 2 hours each are conducted in person in a traditional format.

Textbook and teaching resource

Material and bibliographic references supplied by the professor.

Semester

First semester

Assessment method

ORAL EXAM ON THE TOPICS COVERED IN LECTURES: Oral examination, questions about the topics afforded during the lessons.
No mid-term tests are scheduled.

Office hours

By telephone appointment (02 6448 8209 or 02 6448 8215) or by email (francesco.mantegazza@unimib.it or domenico.salerno@unimib.it).

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING