UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Analytical Methods For Nanobiotechnology

2122-2-F0901D051

Aims

The course aims to provide the students with the knowledge on the general principles enabling to understand which kind of information can be achieved by using the most important analysis techniques for nanobiomaterials characterization.

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 and exercises.

During the Covid-19 emergency period, lessons will take place in a mixed mode: partial presence and asynchronous / synchronous videotaped lessons with some physical presence events.

Textbook and teaching resource

Material and bibliographic references supplied by the professor.

N. R. Zaccai, I. N. Serdyuk, J. Zaccai, “Methods in Molecular Biophysics: Structure, Dynamics, Function for Biology and Medicine”; Editore: Cambridge University Press; ISBN-13: 978-1107056374

Y. L. Lyubchenko, "An Introduction to Single Molecule Biophysics", Editor: CRC-Press; ISBN-13: 978-135133312

D. E. Makarov, "Single Molecule Science: Physical Principles and Models", Editor CRC Press; ISBN-13 : 978-0367575717

Semester

First semester

Assessment method

Oral examination: discussion about a scientific paper previously provided to the student some weeks before the date of the exam.

Written exam: General multiple choice questions about the topics afforded during the lessons.

In the Covid-19 emergency period, exams will be online only. They will be conducted using the WebEx platform and on the e-learning page of the course and a link will be sent to the students to access the exam.

Office hours

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