



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## COURSE SYLLABUS

### Nanobiotechnology Methods

2425-2-F0901D057

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#### 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 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 Titration) 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.

12 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.

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

## **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 by email ([francesco.mantegazza@unimib.it](mailto:francesco.mantegazza@unimib.it)).

## **Sustainable Development Goals**

GOOD HEALTH AND WELL-BEING

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