UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Biophysics Laboratory

2425-3-E3001Q063

Aims

The course will be focused on:

- the characterization of biomolecules and nanoparticles through spectroscopic techniques
- basic principles related to confocal microscopy
- the exploitation of simple artificial intelligence algorithms for data and biophysics/medical image analysis

Contents

Absorbance, Fluorescence, Dynamic Light Scattering, Infrared Spectroscopy, Circular Dichroism, Microscopy, Nanoparticles, Artificial Intelligence methods for data and image analysis

Detailed program

The 8 CFU comprises 2 CFU of data and image analysis through artificial intelligence-based methods. The remaining 6 CFU are related to the Laboratory lessons.
Before the Laboratory, introductory lessons about the different instruments and spectroscopy/microscopy techniques will be illustrated together with data analysis methods.

The main topics are reported in the following:

Absorbance and fluorescence spectroscopy of biomolecules and fluorophores.
Evaluation of the secondary structure of proteins and study of the folding-unfolding processes through optical techniques (circular dichroism, fluorescence and infrared spectroscopy).

Study of biomolecules-small ligands interactions through fluorescence techniques.
Estimate of the proteins dimension and the aggregation state of gold nanoparticles by means of quasi-elastic light scattering.
Hyperthermic effect induced on metallic nanoparticles by an infrared laser and its measurement through a thermal camera.
Fluorescence confocal microscopy applied to image acquisition of cells and biological tissues: image analysis, measurement of the optical resolution of the system.
Data and image analysis through artificial intelligence-based methods (2 CFU)

Prerequisites

knowledge of classical electromagnetism, optics, elements of biophysics

Teaching form

Interactive lessons, in Italian, related to:

- Laboratory in which each group of students will perform the experiments described in the program section (6 CFU)
- Exercises related to data and image analysis by means of artificial intelligence-based algorithms (2 CFU)

Textbook and teaching resource

Textbooks:

Cantor and Schimmel "Biophysical Chemistry"

Robert Pecora, Bruce J. Berne, "Dynamic Light Scattering"

Joseph R Lakowicz, "Principles of fluorescence spectroscopy"

Slides provided on the e-learning site

Semester

Second semester

Assessment method

ORAL EXAM RELATED TO THE LABORATORY REPORT:

The Laboratory report comprises both the theroretical introduction and the description of the developed experiments with the related data analysis. Individual or group reports can be presented for exam evaluation.
Moreover, for each student, an oral exam related to the laboratory reports will be evaluated.

The final grade will be determined by the evaluation of the report, of the knowledge of the different topics covered in the lab, of the experimental data analysis and of the student's behavior throughout the course in the laboratory.

Office hours

Usually the teacher is always available for reception, however the presence is guaranteed only if previously arranged, either in classroom or by e-mail.

Sustainable Development Goals

QUALITY EDUCATION | GENDER EQUALITY | INDUSTRY, INNOVATION AND INFRASTRUCTURE | REDUCED INEQUALITIES | RESPONSIBLE CONSUMPTION AND PRODUCTION | PARTNERSHIPS FOR THE GOALS