UNIVERSITÀ DI PAVIA

Anno Accademico 2020/2021

METHODS FOR THE PROTEIN ENGINEERING

Enrollment year	2020/2021
Academic year	2020/2021
Regulations	DM270
Academic discipline	BIO/11 (MOLECULAR BIOLOGY)
Department	DEPARTMENT OF BIOLOGY AND BIOTECHNOLOGY "LAZZARO SPALLANZANI"
Course	ADVANCED BIOTECHNOLOGY
Curriculum	PERCORSO COMUNE
Year of study	1°
Period	2nd semester (01/03/2021 - 14/06/2021)
ECTS	6
Lesson hours	48 lesson hours
Language	Italian
Activity type	ORAL TEST
Teacher	BINDA CLAUDIA (titolare) - 6 ECTS
Prerequisites	The course deals with topics and methods of Molecular Biology and Biochemistry at advanced level. Therefore, a basic knowledge of these subjects is fundamental.
Learning outcomes	In-depth knowledge of proteins and macromolecular complexes which are at the basis of the biological processes, with special focus on the methods for the three-dimensional structure determination of biomolecules and the biotechnology applications.
Course contents	In particular, the course will comprise the following topics: Biological function of proteins and their chemical properties. Protein structure: primary, secondary, tertiary, quaternary structure. The problem of the mechanism of protein folding. Role of chaperones. Peculiar cases of folding: eukaryotic proteins, membrane proteins, intrinsically disordered proteins. Biotechnology applications of studying

	protein structure: analysis of protein-protein interactions and protein-ligand, biocatalysis and enzymes for industrial interest, drug design. Production of recombinant proteins for structural biology. Protein purification by advanced chromatographic methods, Protein Data Bank (PDB) and bioinformatics tools for protein engineering. Methods for studying the structure of macromolecules. Nuclear Magnetic Resonance (NMR): the magnetic spin moment, the Larmor frequency and the resonance conditions; 1D NMR spectra and multidimensional NMR; examples of structures determined with NMR. X-ray crystallography: crystallization of macromolecules and properties of crystals; theory of X-ray diffraction and experimental methods for data collection; amplitude and phase of diffracted rays and structure factors; analysis of the electron density map and modelling of protein polypeptide chain; examples of structures solved by X-ray crystallography. Electron microscopy: TEM and SEM; Cryo-EM; sample preparation and negative stain; single-particle EM, 3D reconstruction from 2D projections; examples of structures determined by EM. Complementary methods for the study of biomolecules and their biotechnological applications: Surface Plasmon Resonance (SPR), Isothermal Titration Calorimetry (ITC), Microscale Thermophoresis
Teaching methods	Lectures possibly integrated with seminars. No practicals are included.
Reccomended or required readings	“Physical Biochemistry: principles and applications”, David Sheehan, Wiley-Blackwell – 2nd edition
Assessment methods	Oral exam that will verify the acquired knowledge of the topics but also the quality of presentation and the usage of the correct language and terminology.
Further information	Oral exam that will verify the acquired knowledge of the topics but also the quality of presentation and the usage of the correct language and terminology.
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile