UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Industrial Biochemistry

2526-1-F0803Q047

Aims

This course aims to provide students with knowledge in advanced issues in protein biochemistry and in biocatalysis.
Knowledge and understanding.
Students will learn to understand and interpret structure function relationships in proteins and to apply enzymes in biocatalysis.
Applying knowledge and understanding.
Students will learn how to apply knowledge in understanding advanced topics and designing experiments in applied biocatalysis.
Making judgements.
Students will learn to evaluate information provided and to bring it in relation with other advanced scientific issues
Communication skills.
Students will learn to correctly discuss and present topics related to industrial biochemistry.
Learning skills.
Students will become able to analyze scientific literature and to apply and integrate knowledge and information on basic and applied issues in industrial enzymology.
Such skills will be implemented by the style of teaching (discussion encouraged) and through woks about the application or properties of specific enzymes to different fields.

Contents

Advanced issues in the application of biochemical and molecular methods to industrial processes based on proteins and enzymes. Features and application in biocatalysis of classes of industrial enzymes. Discovery and development of superior biocatalysts: enzymes from extremophiles, protein engineering, immobilization. Protein folding in vitro and in vivo with focus on the aggregation of recombinant proteins, chaperones and slow steps in protein folding, such as the formation of disulphide bonds.

Detailed program

FUNDAMENTALS AND APPLICATIONS OF BIOCATALYSIS
Introduction to industrial enzymology
Overview of the fields of application, sources of enzymes, features of relevance in biocatalysis, steps in the preparation of biocatalysts.
How to improve a catalyst's performances
Exploitation of biodiversity: enzymes from extremophiles in particular thermophilic, psychrophilic and alophilic organisms. Enzymes from metagenomics
Protein engineering by directed evolution. Examples of improvements in substrate specificity, robustness to organic solvents and temperature, laboratory evolution of whole operons and metabolic pathway
Enzymes immobilization: adsorption, entrapment, encapsulation, cross-linking, pull-down domains. Examples of tuning enzyme properties by immobilization
Case studies on selected classes of enzymes. This part of the course might be different every year
PROTEIN FOLDING, MISFOLDING AND AGGREGATION
Principles of protein folding
Methods to study the folding of proteins
Thermodynamic and kinetic issues in protein folding. From the first models to "folding funnels" to "phi" analysis.
In vivo protein folding:
Enzymes involved in slow steps: peptidyl prolyl isomerases, protein disulphide isomerases
Folding and holding chaperones, disaggregases.
Expression of recombinant proteins and aggregation in inclusion bodies. Methods to improve protein solubility, methods of protein refolding

Prerequisites

Background. Fundamentals of biochemistry
Prerequisites. None

Teaching form

Teaching activities are conveyed by means of 21 face-to-face 2 hours-lectures composed by:

- a section (approx 34 hours) of delivered didactics(Didattica erogativa, DE) focused on the presentation-illustration of contents by the lecturer.
- a section (approx 8 hours) of interactive teaching (Didattica Interattiva, DI) including teaching interventions supplementary to delivered didactic activities, short interventions by trainees.

Part of the course is based on group work led by the students, the topic of which varies and is agreed at the beginning of the course.

Teaching language: Italian.

Textbook and teaching resource

Slides. Available at the e-learning platform.
Bibliography. Review articles and research articles available at the e-learning Platform.

Semester

Second semester

Assessment method

Oral examination focussed on the whole course topics.

Office hours

Contact: on demand by mail to the lecturer.

Sustainable Development Goals

QUALITY EDUCATION | AFFORDABLE AND CLEAN ENERGY | RESPONSIBLE CONSUMPTION AND PRODUCTION