



UNIVERSITÀ  
DEGLI STUDI DI MILANO-BICOCCA

## COURSE SYLLABUS

### Applied Organic Chemistry To Biotechnologies

2425-2-F5401Q045

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#### Aims

The course is focussed on selected industrial products and their synthetic methodologies through chemical and/or biocatalytic strategies, toward a more sustainable production approach. Advantages and disadvantages of chemical versus (chemo)enzymatic synthesis will be highlighted.

#### Knowledge and understanding

The student will gain knowledge of the chemical principles at the basis of selective and specific chemical reactions; of advantages/disadvantages of chemical vs enzymatic methods; of selected enzyme classes relevant for industrial production (i.e. alcohol dehydrogenases, lipases, esterases)

#### Applying knowledge and understanding

The student will be able to apply the knowledge acquired in the course to synthetic methodologies used in research or in industrial processes.

#### Making judgements

The student will be able to process the acquired knowledge towards the application of chemical and enzymatic methodologies to real problems

#### Communication skills

Use of an appropriate scientific/chemical vocabulary and ability in oral reports

#### Learning skills

Skills in literature reading and understanding, skills in the elaboration of interconnections among the course-related knowledge and other subjects related to industrial biotechnology.

#### Contents

1. Biotransformations and bioprocesses in industrial production
2. Biotechnological approaches to stereoselective and stereospecific transformations, asymmetric synthesis, racemates resolution
3. Synthetic strategies of added value chemicals and industrial products by biotechnological approaches (biotransformations), pros and cons in respect to traditional chemical synthesis
4. Design of experiment (DoE)

## Detailed program

1. Biotransformations and bioprocesses in industrial production: APIs, food additives and flavours, added-value chemicals, bio-based polymers.
2. Biotechnological approaches to stereoselective and stereospecific transformations, asymmetric synthesis, racemates resolution Application to industrial production of APIs, food additives and flavours, added value chemicals, bio-based polymers.
3. Synthetic strategies of added value chemicals and industrial products by biotechnological approaches (biotransformations), pros and cons in respect to traditional chemical synthesis.
  - 3.1 Redox transformations: industrial relevance, classical and biotransformation approaches. Case study: keto-reductases (reaction mechanism, cofactors, substrate specificity, stereoselectivity)
  - 3.2 Carboxylic acid derivative interconversion: industrial relevance, classical and biotransformation approaches. Case study: lipase and esterase (reaction mechanism, substrate specificity, stereoselectivity)
  - 3.3 Phospholipids modification: industrial relevance, classical and biotransformation approaches. Case study: phospholipases (reaction mechanism, substrate specificity, stereoselectivity)
4. Design of experiment (DoE): DoE approaches in the optimization of industrial processes and quality by design

## Prerequisites

Background. Basics of organic chemistry (organic compound classes and their reactivity)

Prerequisites. none

## Teaching form

**21 x 2 hours-lectures composed by:**

- a section of delivered didactics (Didattica erogativa, DE) focused on the presentation-illustration of contents by the lecturer.
- a section of interactive teaching (Didattica Interattiva, DI) including teaching interventions supplementary to delivered didactic activities, short interventions by trainees, case studies, live forum, wooclap. Didactic activities are conveyed by means of face-to-face lectures

Teaching language: italian.

## **Textbook and teaching resource**

Slides available at the e-learning platform of the course

Lectures in the classroom will be recorded and made available in the e-learning page of the course.

Textbooks

David Van Vranken, Gregory Weiss Introduction to Bioorganic Chemistry and Chemical Biology Ed. Garland Science

## **Semester**

First semester

## **Assessment method**

Oral examination. One general question focussed on one wide topic described during the course.

The student shall demonstrate to be skilled in connections among the topics of the course, in scientific vocabulary, comprehension and communication.

## **Office hours**

On demand by mail to the lecturer

## **Sustainable Development Goals**

QUALITY EDUCATION | INDUSTRY, INNOVATION AND INFRASTRUCTURE | RESPONSIBLE CONSUMPTION AND PRODUCTION

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