UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Molecular Biology Applied To The Production of Therapeutic Proteins

2425-1-F0802Q081

Aims

Knowledge and understanding:
At the end of the course, students will gain knowledge of the topics and advanced molecular and cellular biology techniques and their possible biotechnological applications.

Ability to apply knowledge and understanding:
At the end of the course, students will gain the ability to read and understand scientific papers dealing with innovative aspects of biotechnology and to develop applications based on this knowledge.

Making judgements
At the end of the course, students will be able to process what they have learned and to recognize the contexts of application of the advanced molecular and cellular biology techniques of the course.

Communication skills
At the end of the course, students will be able to express themselves appropriately, using a proper vocabulary in the description of the treated topics.

Learning skills
At the end of the course, students will be able to read and understand the literature on the treated topics.

Contents

The course aims to provide a global and reasoned view of the main classic and advanced techniques used for proteins, hormones, growth factors, and new-generation vaccine production, comprising DNA and RNA vaccines. Transient and stable expression systems will be treated in different hosts such as vegetables and microorganisms

useful for both basic research and molecular farming.

Detailed program

Bacteriophages and recombinant bacteria as vaccines or for drug delivery.
Use of yeast for the production of molecules for pharmaceutical use: vaccines, antibodies, hormones, therapeutic enzymes, growth factors. Vaccines based on surface display in yeast and yeast-derived VLPs.
Expression in higher eukaryotes. Transfection of mammalian cells. Viral and retroviral vectors. Recombinant proteins in mammalian cell cultures.
Biomolecular technologies based on the use of plant organisms. Stable or transient transformation of plant species. Methods of biolistic transformation, protoplast transformation, microinjection, bioactive beads. Systems mediated by Agrobacterium tumefaciens; agroinfiltration, agrodrenching. Ti plasmid characteristics and T-DNA transfer mechanism. Engineering of vectors for A. tumefaciens-mediated genetic transformation. Expression vectors for application and basic studies. Marker genes and obtaining marker-free plants. Regulatory sequences of promoters, introns, and leader sequences; transgenesis and cisgenesis in plants to improve the expression of heterologous molecules. Expression and production of vaccines in plants.
Plant viruses as expression systems. The main viral vectors: RNA viruses (Tobacco mosaic virus, Potato virus); DNA viruses (Cauliflower mosaic virus, Geminivirus). Expression of immunogenic proteins, polypeptides, and epitopes by viruses that form Virus Like Particles (VLP). Viral vectors for functional genomic studies by expression of small interfering RNAs: Tobacco rattle virus, Tomato bushy stunt virus.
Elements of gene therapy.
Biotechnological vaccines and their design. Some examples of biotechnological vaccines: anti-hepatitis B, anti-HPV, anti-Rotavirus, and conjugated polysaccharide vaccines. Rational design of DNA and RNA vaccines.

Prerequisites

Backgrounds. Basics of Molecular Biology.
Prerequisites: none.

Teaching form

11 Traditional Lectures based on delivered didactics (Didattica erogativa, DE) focused on the presentation of concepts by the lecturer.
10 Lectures based in part on delivered didactics by the teacher (DE), in part on Interactive teaching (Didattica Interattiva, DI) consisting in search and analysis of scientific papers and subsequent oral presentations by the students.
Lectures are in presence unless straordinary condition
Teaching laguage: italian

Textbook and teaching resource

Slides and a selection of scientific papers. Available at the e-learning platform of the course. The teaching materials will be in English.

Semester

First semester

Assessment method

Oral examination. The student will present a paper of his/her choice and will answer few questions on the topics introduced during the course.

Office hours

On demand by email to the lecturer.

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING | QUALITY EDUCATION