UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Advanced Cellular Technologies

2425-1-F0601Q122

Aims

Upon completion of this course, students should have:
• a detailed understanding of advanced tools, resources and techniques in molecular biology;
• an understanding of how these techniques are used to study gene and protein functions in cells and organisms;
• an appreciation of the information resources available to assess the usefulness of a particular technique
• acquired the knowledge to enable them to critically appraise new data arising from the use of these techniques and to interpret the implications of such data.
• the ability to critically read and interpret complex literature in order to answer detailed questions on both theory and methodology

Contents

The course is focused on the use of molecular techniques to study gene and protein functions in higher eukaryotes. It aims to provide students with an advanced understanding of the strategies and techniques of relevance to research in advanced molecular biology and medicine. Topics will be drawn from the current literature and ongoing research in molecular biology: they include DNA/RNA sequencing approaches and methodologies to analyze RNA and proteins expression. The course is not intended to be comprehensive – rather a number of topics will be covered in some depth.
The course consists in a series of lectures and problem solving sessions through active learning exercises. In addition, students are involved in a literature project, which will be performed in groups. Each group presents a recent molecular cell biology-related scientific research paper. This project aims to teach critical reading, interpretation and comparison of the most advanced techniques in the field of molecular biology. Presence in class is highly recommended.

Detailed program

Lecture Topics

- How to analyse the genome (Sanger seq, NGS, applications and evolution of NGS)
- How to analyze the transcriptome (Reverse Transcription , PCR, qPCR, RNA-seq, scRNA-seq)
- How to analyze the proteome (biochemical and cellular approaches)
- How to manipulate gene expression (gain–of-fuction vs. loss-of-function approaches)

Active learning exercises
Three different in-class problem-solving sessions will be held during the course. This are instructor-led group activities were students will learn (i) to navigate gene databases to extract gene and transcripts information, to design and execute experiments, such as PCR and qRT-PCR; (ii) to determine a protein's subcellular location based on experimental results, to understand how different experimental techniques can be used to assess protein localization.

Presentations
Group exercise (2-4 students) in which students will select a paper among a set of articles that will be made available during the course. The paper will include the use of at least one of the methodologies that will be presented in the lectures. Students will need to identify and read at least three "support articles" including review articles, previous work, etc. A one-page outline of the talk, including the list of references, will have to be provided in advance. Each presentation should be 15 minutes in length, using about 15 slides per presentation.

Prerequisites

BSc-level understanding of genetics, molecular and cellular biology.

Teaching form

24 2-hour lectures consisting of:

- part in delivery mode (didactic delivery, DD) focused on presentation/illustration of content, concepts, scientific principles
- part in interactive mode (interactive didactics, DI), which includes problem solving sessions through active learning exercises, and the discussion of literature that will be carried out in groups.
  All activities are conducted in presence.

Textbook and teaching resource

The course will use review articuls as a starting point, and original recent work. PDF files of the slides will be provided. Will be available on the elearning Platform.

Semester

First semester

Assessment method

Individual oral discussion of a selected journal article to be chosen from a list that will be made available during the course. and questions concerning the general theoretical part.

Office hours

Upon appointment writing to: silvia.barabino@unimib.it

Sustainable Development Goals