UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Analisi di Funzioni Geniche

2627-3-E0201Q057

Aims

The course aims to provide students with knowledge of classic and molecular genetics methodologies for the study of gene functions in eukaryotes and their implications in problems of biotechnological interest. Some aspects of gene regulation in both prokaryotes and eukaryotes will also be discussed, as well as the genetic bases and the consequences of transposition and the biology and the functions of noncoding RNAs in either physiological and pathological conditions.
Knowledge and understanding. At the end of the course the student will know the principal genetic and molecular methodologies to study the function of genes in different model systems and their use for the study of some biological processes.
Applying knowledge and understanding. At the end of the course the student will be able to identify the most appropriate molecular-genetics methodologies to study the function of essential and non-essential genes in different experimental contexts and design simple experiments to study the function of these genes.
Critical and judgment skills. Through the critical analysis of research papers carried out interactively in class, the reconstruction of original scientific paths and the interpretation of experimental data, at the end of the course the student will be able to process what has been learned and recognize situations and problems in which the genetic methodologies learned can be used.
Communication skills. At the end of the course the student will be able to properly describe and discuss the topics addressed with language properties and specific terminology.
Learning skills. At the end of the course the student will be able to analyze, apply and integrate the course-related knowledge with other knowledge related to the study of biological processes.

Contents

Gene inactivation and other genetic methodologies for the study of gene function in yeast and in multicellular eukaryotes. Transposable elements, their effects on genetic variability and their applications. Aneuploidy and chromosomal aberrations, evolutionary advantages and consequences on human health. Examples of complex gene regulation in eukaryotes. Non-coding RNAs and their deregulation in human diseases.

Detailed program

Detailed program
Introduction to functional genetic analysis. Gene inactivation methodologies in yeast and multicellular eukaryotes and other genetic methodologies for the study of the function of either non-essential and essential genes. Genetic manipulation in model organisms (S. cerevisiae; D. melanogaster, C. elegans, M. musculus). Gene manipulation for the creation of animal models of human diseases.
Transposons and retrotransposons. Transposition mechanisms. Transposons and genetic variability. Mutagenesis induced by transposons and applications. Aneuploidy and chromosomal aberrations, cytogenetic analysis for the detection of chromosomal aberrations, mechanisms of formation of chromosomal abnormalities, effects of aneuploidies: evolutionary advantages and consequences on human health. Gene regulation in prokaryotes and eukaryotes. Examples of post-transcriptional regulation. Splicing and alternative splicing: the determination of sex in Drosophila melanogaster.
Non-coding RNAs and their functions. Functions and maturation of micro-RNA (miRNA) and small interfering RNA (siRNA). Long non-coding RNAs (lncRNA) and their role in gene regulation.

Prerequisites

Background: Basic knowledge of genetics and molecular biology.
Specific prerequisites: Genetics.
General prerequisites: Students can take the exams of the third year after passing all the exams of the first year of the course.

Teaching form

Teaching modality: lecture-based (DE) or lecture-based/interactive (DE/DI), in person.
Specifically:

- 5 lessons of 2 hours each delivered in lecture-based mode, in person;
- 16 lessons of 2 hours each delivered in lecture-based mode in the initial part, followed by an interactive phase aimed at engaging students. All activities take place in person.

The various topics, the genetic methodologies used to address them, and their potential implications for biotechnology and human health will be presented with the support of electronic presentations and further explored through appropriate examples and experiments, actively involving students in the interpretation of experimental data. Original research articles will also be discussed interactively.
The course is taught in Italian.

Textbook and teaching resource

Learning material (slides of the lessons, and scientific publications described during the classes) is available at the e-learning web page of the course.

The lessons will be video recorded and the video recordings will be made available at the e-learning web page of the course.

Recommended textbooks:

- Hartwell L. H, “Genetica: dall’analisi formale alla genomica”, McGraw-Hill
- Russel P.J., “Genetica, un approccio molecolare”, Pearson
- Lewin B., “Il gene VIII”, Zanichelli
- Strachan T., Read A., "Genetica molecolare umana", Zanichelli

Semester

first semester

Assessment method

Oral examination. Specifically, students will be asked to discuss and apply the approaches and methodologies learned during the course to the study of genes and their functions, or to the analysis of biological processes, through concrete examples. In addition, they will be required to interpret experimental data (graphs, images, tables) drawn from the research articles discussed in class.

Office hours

Contact: on demand, upon request by mail to lecturer, or at the end of each lecture.

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING