UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Functional Analysis of Genes

2021-3-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.
Making judgment. At the end of the course the student must be able to elaborate the acquired knowledge and recognize situations and problems in which the genetic methods acquired 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. Examples of complex gene regulation in prokaryotes and eukaryotes. Non-coding RNAs and their deregulation in human diseases.

Detailed program

- Methods of gene inactivation in yeast and in multicellular eukaryotes and other genetic methodologies for the study of gene function.
- 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.
- Regulation of the choice between lytic cycle and lysogenic cycle in the lambda bacteriophage.
- Regulation of tryptophan synthesis in bacteria: Trp operon and attenuation mechanism.
- Splicing and alternative splicing: the determination of sex in Drosophila melanogaster.
- Genes with maternal effect and maternal effects in the regulation of gene expression during development.
- 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. Non-coding RNAs in tumorigenesis, in human diseases and as targets for therapeutic strategies.

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

Classroom lessons supported by PowerPoint presentations. The problems, the genetic methodologies that can be tackled to investigate them, and the possible applications of biotechnological interest and for human health will be explored through appropriate examples and experiments. Original research articles will also be presented and discussed.
Teaching language: 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.

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

Semester

First semester

Assessment method

Written examination (2 h and 30 min) + oral examination. Written examination consists of open questions on the whole course content. Oral examinantion consist of a discussion on the same topics of the written exam.

Office hours

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