UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Biology and Genetics

2223-1-H4601D066

Aims

Knowledge of the main concepts in the structure and function of prokaryotic cells, eukaryotic and viruses, as well as laws governing the variability and inheritance.

Knowledge of the main concepts of molecular biology, with particular regard to the processes of DNA replication and control of gene expression.

Knowledge of the molecular mechanisms that control cell division and differentiation, with particular regard to the alterations of those mechanisms that are involved in human diseases

Contents

Structure and function of the most important cellular macromolecules; DNA duplication and repair mechanisms; transcription and RNA processing; translation and protein sorting; molecular and cellular mechanisms responsible for gene expression and its regulation, analyzing epigenetic mechanisms, transcriptional and post-transcriptional regulation; signal transduction pathways; molecular and cellular mechanisms which control the cell cycle, cellular growth and differentiation as well as cell-to-cell interactions; basic concepts of heredity and the transmission patterns of inherited traits; mechanisms which can generate phenotypic variants in men; methodologies used in genetic analysis; most important biotechnological applications in medicine (gene-based and cell-based therapy).

Detailed program

GENERAL BIOLOGY

Cell theory: principles of classification of living organisms, structure and organization of prokaryotic and eukaryotic cells, viruses, genes, structural differences between prokaryotic and eukaryotic genes, genome organization in prokaryotes and eukaryotes; characteristics of the human genome, variability and inheritance; the laws of Mendel and integrations.

MOLECULAR BIOLOGY

The chemical composition and molecular organization of the cell:water, carbohydrates, lipids, proteins, nucleic acids, the identification of the chemical repository of genetic, molecular basis of the hereditary information; DNA replication and telomerase, DNA repair, with correlations to: human disease and cellular aging and cancer; RNA structure and function, transcription and RNA maturation, general characteristics of the genetic code, protein synthesis, the fate of post synthetic protein, regulation of gene expression in prokaryotes and eukaryotes, the tools of genetic engineering (restriction enzymes, vectors, Southern-blotting, PCR, sequencing), the molecular cloning.

CELL BIOLOGY

Structure and function of the cytoskeleton, adhesion mechanisms between cells and the extracellular matrix, the communication between cells in multicellular organisms (regulating endocrine, paracrine, autocrine) signal transduction and the central role played by protein kinases, cell cycle and its genetic control, apoptosis, mitosis and meiosis, crossing-over and genetic consequences, and implications for X chromosome inactivation in the manifestation of syndromes and genetic diseases, principles and consequences of genomic imprinting and mitochondrial inheritance, multifactorial inheritance, and quantitative genetics ; cancer genetics: genes that contribute to the onset of cancer (Rb1,p53, and WT1); the immunogenetics and the generation of antibody diversity.

Prerequisites

Aims of the course Scienze Propedeutiche

Teaching form

Frontal lectures

Textbook and teaching resource

Main Textbook

G. De Leo, E. Ginelli, S. Fasano. Biologia e Genetica EdiSES, 2013

More Resources

- H. Lodish, A. Berk, S.L. Zipursky, P. Matsudaira, D. Baltimore, J. Darnell. Molecular cell biology, Ed. FREEMAN, 9. ed. 2021

- G. Karp. Biologia cellulare e molecolare 3° ed EDISES, 2007

- Strachan. Human molecular genetics, 4° Ed. GARLAND SCIENCE, 2010

- P.J. Russell. Genetica. 2° ed EDISES, 2007

- B. A. Pierce. Genetica. ZANICHELLI, 2005.

PPt slides form frontal lectures

Semester

2nd semester

Assessment method

One exam for all three sections of the course. Written test multiple choices (around30) and 2-3 open shorts questions on all three modules. The examination is intended to test students' knowledge acquired in the different modules of the course.

Office hours

On appointment

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING