UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Biologia Applicata

1819-1-H4101D004-H4101D012M

Aims

The course will provide the essential theoretical knowledge of biology and genetics, also focusing on the possible future application in the medical field. The subjects of the course will provide the necessary knowledge to understand the vital processes, as well as the laws of heredity and the processes involved in the generation of phenotypic diversity.

Contents

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.

Detailed program

GENERAL BIOLOGY

– Classification of living organisms – Structure od prokaryotic and eukaryotic cells – Viruses, classification, lytic and lisogen cycle.

CELL BIOLOGY

Translation – Protein sorting – Gene expression regulation in prokaryotes and eukaryotes – Structure and function of the cytoskeleton – Cell adhesion mechanisms – Endocytosis and Exocytosis – Cell-to-cell communication in complex organisms – Signal transduction and the role of protein kinases – Cell cycle and its regulatory mechanisms. _ Mytosis and Meiosis – Apoptosis – Cell differentiation processes: embrional and adult stem cells.

GENETICS

– Human reproduction – Genetic variability – Inheritance – Genes: genotype and phenotype – Diploidy and reproduction. Honologous chromosomes, alleles and loci, homozygosity and heterozygosity – Mendel's laws – Alleles: wild-type, mutated and multiple ones, dominance and recessivity – Mendel's law's implementation: epistasis, penetrance and expressivity – Sex chromosomes. Sex determination – How to build and analyze a family tree – Chromosome X inactivation. Its implication in the phenotipic manifestations of genetic diseases – Test cross and inheritance of genes localized on different chromosomes – Crossing over and its genetic consequences – Recombination frequencies calculation and genetic maps – Principles and consequences of mytochondial inheritance and genomic imprinting – Examples of monogenic inheritance: blood groups (AB0, Rh), color blindness – Multigenic inheritance and quantitative genetics – Characters showing a treshold effect – Multifactorial disorders – Population genetics and Hardy-Weinberg equilibrium.

MOLECULAR GENETICS

Relationship between DNA content and organism complexity – DNA assembly in the nucleus of eukaryotic cells – Structural differences between prokaryotic and eukaryotic genes – Genome organization in prokaryotic and eukaryotic cells. Characteristics of human genome – Gene mutations: development mechanisms – Mutation consequences on gene products – Examples of autosomic domint and recessive mutations, as well as X-linked ones – Mytochondrial gene mutations – Genomic instability - DNA plymorphisms and their use as genetic markers – - Elements of developmental biology – Immunogenetics. Generation of antibody diversity - Cancer genetics. Oncogenes and tumor suppressor genes (Rb1, WT1 and p53) – Stategies for the diagnosis of genetic diseases (direct and indirect) – The human genome project: future implications – Gene therapy: general concepts and applications.

Prerequisites

Basic sciences (chemistry, physics)

Teaching form

Lectures

Group discussion

Textbook and teaching resource

G. De Leo, E. Ginelli, S. Fasano. BIOLOGIA E GENETICA, EdiSES, 2013

other textbooks:

E.Ginelli, M.Malcovati. MOLECOLE, CELLULE E ORGANISMI, EdiSES, 2016

H. Lodish, A. Berk, S.L. Zipursky, P. Matsudaira, D. Baltimore, J. Darnell. MOLECULAR CELL BIOLOGY, FREEMAN, 2016.

Strachan. GENETICA MOLECOLARE UMANA, Zanichelli, 2014

P.J. Russell. GENETICA UN APPROCCIO MOLECOLARE. PEARSON, 2014.

Semester

Second semester

Assessment method

See information provided for the whole course

Office hours

By appointment