UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Marine Molecular Biology

2122-2-F7502Q019

Aims

This course introduces the basic aspects of the molecular and cellular biology of marine organisms. Topics include the methodology and applications of molecular biology as a means of examining ecosystem-wide biological processes. At completion of the course, the students should be able to define specific biological problems with corresponding molecular markers, to design compatible experimental procedures and to define the necessary analytical protocols.

Contents

Principles and applications of molecular biology tools (genomics, transcriptomics and proteomics) for the study of marine ecology.

Detailed program

Section 1: Molecular tools for marine biology and ecology

- Introduction
- Organization and structure of genomes.
- Principles of molecular evolution of genes.
- Relationship between gene regulation and biological functions.
- Phylogenetic relationships among marine organisms

- Marine ecological genomics:
    - Genome sequencing methods: dideoxy procedure, primer walking, pyrosequencing, use of reversible chain terminators, sequencing by ligation, large-scale DNA sequencing methods: shot-gunning strategy for sequencing genomes, cyclic array
    - sequencing whole genome of key organisms, genome comparison for phylogeny, genomic analysis of natural communities, genomic analysis of communities (genome ecology),
    - Polymerase Chain Reaction (PCR): principles and application in marine ecology
    - Species identification by barcoding.
- Transcriptomic:

o Quantitative real-time polymerase chain reaction (QPCR): principles and probes;

o Absolute and quantitative analyses

    - RNase protection-based assays
    - CDNA subtractive hybridization(SSH)
    - DNA arrays: cDNA and oligonucleotide arrays
    - Comparative approaches to cellular functions based on molecular analyses.
- Proteomic:
    - Preparation of protein samples from bacteria, plants and animal tissues.
    - SDS PAGE and protein detection by Western analysis.
    - 2D gel electrophoresis: 2D protein patterns, mass spectrometry and comparative analyses.

Section 2: Application of molecular markers in marine biology and ecology

- Introduction:
    - Types of molecular markers and their applicability – a matter of scale
    - Basic concepts in evolution – why molecular data markers?
    - Specific concepts on genetics
- Markers and the individual
    - Barcode of life revisited - a tool to understand biology
    - Parentage, relatedness
- Markers and population
    - Basic principles of population genetics
    - Phylogeography
- Markers and species
    - Speciation
    - Phylogeny
    - Biogeography
- Markers and communities
    - Metagenomics
    - Invasive species
- Conservation genetics in the marine environment

Prerequisites

Undergraduate Molecular Biology and Ecology

Teaching form

Lessons and seminar activities.

Textbook and teaching resource

The students can use "Gene Cloning and DNA Analysis: An Introduction" T.A. Brown 7th Edition as general textbook. The teaching material used for the lessons is available on the e-learning platform.

Semester

The course will take place in the first semester according to a timetable that will be published.

Assessment method

Examination type: Oral examination. Students will perform a presentation focused on a research paper based on Molecular Biology approach and they will discuss about the principles and applications of technologies introduced in this course.

Mark range: 18-30/30

Office hours

The teacher will receive by appointment. Monday - Friday 9.00-17.00