



GENETICS AND MOLECULAR METHODOLOGIES

Enrollment year	2021/2022
Academic year	2021/2022
Regulations	DM270
Academic discipline	BIO/18 (GENETICS)
Department	DEPARTMENT OF BIOLOGY AND BIOTECHNOLOGY "LAZZARO SPALLANZANI"
Course	EXPERIMENTAL AND APPLIED BIOLOGY
Curriculum	Bioanalisi
Year of study	1°
Period	2nd semester (01/03/2022 - 14/06/2022)
ECTS	6
Lesson hours	48 lesson hours
Language	
Activity type	ORAL TEST
Teacher	ACHILLI ALESSANDRO (titolare) - 6 ECTS
Prerequisites	Students must have acquired the contents of Genetics and Molecular Biology, which will be crucial to understand how to study the molecular, phylogenetic and functional characteristics of DNA.
Learning outcomes	<p>This course will focus on the recent advances in molecular genetics and on their application to investigate nuclear/cytoplasmic genomes. The first part provides an overview of molecular genetics techniques to study and characterize entire genomes, with implications in the field of biomedicine and biotechnology.</p> <p>During the first part, we will explore the basis of molecular phylogenetics (focusing on the human mitogenome, which is also target of the practical training) whose objective is to reconstruct the tree-like pattern that describes the evolutionary relationships between the organisms, with applications in the fields of medical, forensics and population</p>

	<p>genetics.</p> <p>At the end of the course students will be able to apply scientific methodology to solve problems of molecular genetics and to participate in group discussion on a topic of research.</p>
Course contents	<p>Introduction to genomics. Genomes, transcriptomes and proteomes. Origin and evolution of genomes. Prokaryotic genome and lateral gene transfer. Extranuclear inheritance and the genetic/molecular characteristics of cytoplasmic genomes. Human mtDNA as an example of animal mitochondrial genome.</p> <p>Enzymes for DNA manipulation: DNA polymerases (and PCR), nucleases, ligases. Optimized methods for total nucleic acid extraction and quantification. PCR amplification and RFLP analysis. The application of molecular genetics approaches to study the human mtDNA: Cybrids and mitochondria dysfunctions; RFLP analyses and whole genome sequencing.</p> <p>Whole genome sequencing (WGS): automated classical method (Sanger); shotgun and hierarchic approaches. Gene libraries and cloning vectors. Next generation sequencing (NGS) systems: e.g. Illumina sequencing and Ion torrent.</p> <p>Molecular markers: classification (microsatellites and SNPs) and screening (Chip).</p> <p>Analysis of genomic sequences. Looking for an Open Reading Frame (ORF). Assigning a gene function: computer-based and experimental approaches. Forward and reverse genetics (e.g. ATM).</p>
Teaching methods	<p>Face to face lessons and practical training.</p>
Reccomended or required readings	<p>BIOTECNOLOGIE MOLECOLARI (Principi e tecniche) Seconda edizione (Brown TA – Zanichelli)</p> <p>Genomes (Brown TA – Edises).</p> <p>Presentation slides will be crucial for the final exam.</p>
Assessment methods	<p>Oral exam: an interview on the topics covered during the lectures and on laboratory activities.</p>
Further information	<p>For further information:</p> <p>alessandro.achilli@unipv.it</p>
Sustainable development goals - Agenda 2030	<p>Some of the topics in this course are in line with the 2030 Agenda for Sustainable Development, in particular with Goal 15 - Protect, restore and promote sustainable use of terrestrial ecosystems / halt biodiversity loss.</p> <p>\$lbl_legenda_sviluppo_sostenibile</p>