General Information	BACELOR DEGREE IN BIOTECHONOLOGIES
Title of the subject	Molecular Genetics and Genetic Engineering
Degree Course (class)	Industrial and Agro-Food Biotechnologies
ECTS credits	8
Compulsory attendance	YES
Language	ITALIAN
Academic year	2020/2021

Subject Teacher		
Name and Surname	René Massimiliano Marsano	
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Place and time of reception	Department of Biology, room 40 third floor Every day by email appointment	
ECTS credits details	Discipline sector (SSD)	Area
	BIO/18	---

Study plan schedule	Year of study plan	Semester
	THIRD	FIRST

Time management	Lessons	Laboratory	Exercises	Total
CFU	6	2		8
Total hours	150	50		200
In-class study hours	48	24		72
Out-of-class study hours	102	26		128

Syllabus	
Prerequisites / Requirements	
Basic concepts of Genetics and Molecular Biology are required	
Expected learning outcomes (according to Dublin descriptors)	
Knowledge and understanding	Acquisition of adequate knowledge of molecular genetics and genetic engineering, aimed at manipulating biological systems and producing molecules of biotechnological interest.
Applying knowledge	The laboratory activity will enable students to select and use genetic engineering and molecular analysis techniques with the aim to study systems and components of biotechnological interest in the field of fundamental and industrial research.
Making informed judgments and choices	Students should be able to interpret and evaluate experimental data autonomously, and to set strategies aimed to study and functionally modify genes and genomes.
Communicating knowledge	Students should develop the ability to describe complex genetic

	phenomena in a clear and concise way.
Capacities to continue learning	Students acquire the ability to investigate aided by the critical reading of scientific reports, texts and online databases.
Study Program	
Content	**GENOME'S STRUCTURE** Heterochromatin and euchromatin Centromeres and telomeres Genomic complexity and C value paradox. Single copy sequences and repeated sequences. Mobile DNA sequences in the genome. Classification. Mechanisms of transposition in eukaryotes and prokaryotes. Transposable elements and their use in molecular genetics and genetic engineering. The P transposable elements of Drosophila and the hybrids dysgenesis. Transposable elements as mutagenesis tools. P-element mediated germline transformation and selection of transgenic individuals. Genetic screening by insertional mutagenesis performed with P elements. Engineered P elements. Enhancer-trap lines. Other transposition systems of biotechnological interest: Sleeping Beauty and piggyBac. TRANSCRIPTIONAL AND POST-TRANSCRIPTIONAL CONTROL OF GENE EXPRESSION Lac operon as a transcription paradigm in prokaryotes: Jacob and Monod experiments. Control Elements in the eukaryotic genes expression process. Promoters, enhancers, silencers, insulators: isolation and characterization strategies. Post transcriptional regulation; splicing and alternative splicing; editing. RNA interference: origin and function of miRNAs and siRNAs. Chromatin and chromosomes; chromatin structure and gene regulation, epigenetic effects. Use of regulatory sequences in genetic engineering. Ectopic expression systems: Gal4-UAS GENETIC ENGINEERING Cloning vectors (plasmid vectors, phage vectors, High-capacity vectors, cosmids, BACs, PACs, expression vectors). Variations of PCR: iPCR, Molecular genetics of yeast: S. cerevisiae, tools and methods. Cloning in Saccharomices cerevisiae; yeast replicative plasmids, yeast artificial chromosomes; construction of plasmids by homologous recombination in yeast; gene targeting and gene transplacement. Molecular hybridization: principles and methods; Southern blot, Northern blot, colony hybridization, Fluorescent in situ hybridization (FISH). Genomic DNA libraries in high-capacity vectors; Library screening strategies. Gene expression methods, cDNA collections screening; 5 'and 3' RACE. Microarrays, qRT-PCR, RNAseq. Strategies and vectors used in gene transfer. Site specific mutagenesis in vitro. Genome editing: ZNFs, TALENs, CRISPR / CAS systems.

	MOLECULAR GENETICS IN APPLIED BIOTECHNOLOGIES. Some examples, taken from the most modern scientific literature, concerning the genetic engineering methods applied in environmental and industrial biotechnologies are discussed. LABORATORY Drosophila as a model organism in Genetics Preparation of polythene chromosomes from Drosophila salivary glands Microinjection in embryos and adults of Drosophila Behavioral tests in Drosophila. Use of online resources for molecular genetics
Bibliography and textbooks	Genetica Principi di analisi formale Griffiths, Zanichelli ANALISI GENETICA AVANZATA, MENEELY, MCGRAW-HILL
Notes to textbooks	
Teaching methods	Lessons and practice sessions
Assessment methods (oral, written, ongoing assessment)	Oral exam
Evaluation criteria (describe criteria for each of the above expected outcomes)	Besides the assessment of the notions' acquisition, the student's ability to integrate them in the explanation of phenomena of interest is assessed.
Further information	