Main course information	
Academic subject	Biologia Molecolare
Degree course	Scienze Biologiche
Degree class	L-13
ECTS credits (CFU)	10
Compulsory attendance	YES
Teaching language	Italian
Accademic Year	2019/2020

Professor/Lecturer	
Name & SURNAME	Palmiro Cantatore
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Tel.	080-5443378
Tutorial time/day	Monday, Wednsday: h 11-13

Course details	Pass-fail exam/Exam with mark out of 30	SSD code	Type of class
		BIO/11	Lecture/workshop

Teaching schedule	Year	Semester
	III	1st

Lesson type	CFU/ECTS	Lessons (hours)	CFU/ECTS lab	Lab hours	CFU/ECTS tutorial/workshop	Tutorial/workshop hours	CFU/ECTS field trip	Field trip Hours
	9	72	1	12	0	0	0	0

Time management	Total hours	Teaching hours	Self-study hours
	250	84	166

Academic Calendar	First lesson	Final lesson
	01.10.2019	19.01.2020

Syllabus	
Course entry requirements	Knowledges of OrganicChemistry and Biological Chemistry
Expected learning outcomes (according to Dublin Descriptors) (it is recommended that they are congruent with the learning outcomes contained in A4a, A4b, A4c tables of the SUA-CdS)	
Knowledge and understanding	Learn the structural characteristics of genes and mechanisms of replication transcription, translation and regulation of gene expression
Applying knowledge and understanding	Acquisition of: biomolecular and biotechnological concepts and of methodologies for biological research
Making informed judgements and choices	Acquisition of conscious autonomy in areas related to evaluation e interpretation of experimental data
Communicating knowledge and understanding	Acquisition of adequate skills and tools for communication in Italian and foreign language (English), in written and oral form, and through the use of graphic and formal languages. The verification will take place by means of different examination tests. The ability to communicate in English will be acquired through a specific course focused on the use of scientific language in the field of biological themes. Acquisition of computer skills related to data processing and presentation both through frontal teaching and through e-learning.
Capacities to continue learning	Acquisition of skills that favor the development and deepening of the skills, with particular reference to the consultation of bibliographic material, to the

	consultation of databases and other information on the net, to the use of basic cognitive tools for continuous updating

Sylabus	
Course content	1. STRUCTURE OF NUCLEIC ACIDS: The molecular nature of genes: role of DNA as a genetic material. Nucleotides. The components of DNA. The RNA. The double helix structure of DNA. Major groove and minor groove. Alternative forms of the double helix: the helix A and the helix Z. Plasticity of the DNA structure. Unusual DNA structures. DNA supercoiling. Topoisomerase and gyrase. Genes and genomes: general features of prokaryotic and eukaryotic genomes. The human genome. Nucleosomes and chromatin. DNA packaging 2. DNA REPLICATION AND REPAIR: Semi-conservative DNA replication. Meselson and Sthal experiment. Unidirectional and bidirectional replication. The replication fork. DNA synthesis at the level of the replication fork: DNA polymerase III. Beginning of replication. Selection of origins and regulation of replication in prokaryotes and eukaryotes. Termination of replication in prokaryotes and eukaryotes. DNA damage induced by physical, chemical and biological agents. Repaire systems in E. coli and eukaryotes: direct repair; repair of pairing errors; base excision repair; nucleotide excision repair; SOS response; repair by recombination. 3. GENe REARRANGEMENTS: Homologous recombination. Halliday model. Recombination with double helix cut. Enzymes involved in recombination and their mechanism of action. Site-specificte recombination. Effects of site-specific recombination. Integration of lambda phage. Transposition. Transposable elements in prokaryotes and eukaryotes. Mechanism of transposition of DNA elements. Transposition mediated by RNA elements. Reverse transcriptase function. Mechanism of retroviral cDNA formation and integration into chromosomal DNA. 4. SYNTHESIS AND MATURATION OF RNA. RNA: types and characteristics. RNA synthesis. RNA polymerase of E.coli. Initiation of the transcription Elongation. Intrinsic transcription termination and rho dependent termination. Antitermination Post-transcriptional modifications in prokaryotes. RNA synthesis in eukaryotes: eukaryotic RNA polymerases. Eukaryotic promoters. Recognition of promoters and beginning of transcription. Enhancers sequences and transcription factors. Post-transcriptional modifications in eukaryotes: capping, polyadenylation. Interrupted genes: appearance and role of introns. Splicing mechanism of mRNAs: transesterification; spliceosomes. Autosplicing and the discovery of catalytic RNA. Splicing of tRNAs. Comparison between the different splicing mechanisms. Alternative splicing and shuffling of exons. RNA editing. THE PROTEIN SYNTHESIS: The genetic code: definition, identification and characteristics. tRNA structure. Codon-anticodon interaction. Wobble hypothesis. Activation of amino acids: role and mechanism of action of aminoacyl tRNA synthetase. Ribosomes. The mRNA. Recognition of the signal to initiate translation in prokaryotes. Formation of the initiation complex. Elongation phase of protein synthesis: factors Ts and Tu. Peptide bond formation. Translocation. Termination and recycling of the translation apparatus. Comparison between protein synthesis in prokaryotes and eukaryotes. Protein synthesis inhibitors. 6. REGULATION OF GENE EXPRESSION IN PROCARIOTS: The operon of lactose. Regulation by the repressor and the CAP protein. The Arabinose operon. Tryptophan operon: attenuation. Regulation of the life cycle of the lambda phage. Role of CI and the Cro protein in the transition between the lytic and lysogenic cycle of the lamda phage TECHNIQUES OF MOLECULAR BIOLOGY 1. CENTRIFUGAL TECHNIQUES 2. EXTRACTION OF NUCLEIC ACIDS

	3. QUANTITATIVE ANALYSIS OF NUCLEIC ACIDS 4. ELECTROPHORESIS OF NUCLEIC ACIDS 5. RESTRICTION ENDONUCLEASES 6. LABELLING OF NUCLEIC ACIDS 7. DENATURATION, RINATURATION AND HYBRIDATION 8. PCR 9. DNA SEQUENCING:, Sanger method, automatic sequencing. Introduction to NGS methods MOLECULAR CLONING TECHNIQUES: Introduction. Preparation of the DNA fragment (s) to be cloned. Covalent union of DNA segments. Cloning vectors. Transfer to a host cell. Recombinant DNA selection. Cloning vectors based on the phage genome. Insertion vectors. Replacement vectors. Gene library.
Course books/Bibliography	WATSON J. et al. - Biologia molecolare del gene - Zanichelli AMALDI F., BENEDETTI P., PESOLE G., PLEVANI P. -Biologia Molecolare – CEA R.F. WEAVER - Biologia Molecolare- Ed. McGraw-Hill Seconda Edizione G. PARISI - Estrazione, Purificazione e Caratterizzazione degli Acidi Nucleici - CLEUP Editrice Padova. Vol I, III T.A. BROWN - Biotecnologie Molecolari - Zanichelli J.W. DALE e M. VON SCHANTZ -Dai Geni ai Genomi – EdiSES
Notes	
Teaching methods	The teaching of the course includes both lectures and exercises of laboratory. The frontal lessons are carried out on the blackboard using teaching aids such as the video projection of summary slides. The practical exercises are carried out in groups of about 20 students, taking care that the students personally carry out the various experiments. Students are required to carry out and deliver written reports of the exercises carried out at the end of the course.
Assessment methods (indicate at least the type written, oral, other)	Oral Examination and Laboratory Reports
Evaluation criteria (Explain for each expected learning outcome what a student has to know, or is able to do, and how many levels of achievement there are	The student must demonstrate knowledge of the basic mechanisms related to the structure and function of nucleic acids. Furthermore the student must demonstrate knowledge of the basic techniques of Molecular Biology carried out during the Course.
Further information	