



UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze e Tecnologie Biologiche, Chimiche e Farmaceutiche		
ACADEMIC YEAR	2021/2022		
BACHELOR'S DEGREE (BSC)	BIOTECHNOLOGIES		
INTEGRATED COURSE	MICROBIOLOGY AND APPLIED BIOTECHNOLOGIES - INTEGRATED COURSE		
CODE	15237		
MODULES	Yes		
NUMBER OF MODULES	2		
SCIENTIFIC SECTOR(S)	BIO/03, BIO/19		
HEAD PROFESSOR(S)	PALLA FRANCO	Professore Associato	Univ. di PALERMO
OTHER PROFESSOR(S)	PALLA FRANCO GALLO GIUSEPPE MIRKO NAZARENO	Professore Associato Professore Associato	Univ. di PALERMO Univ. di PALERMO
CREDITS	12		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	2		
TERM (SEMESTER)	2° semester		
ATTENDANCE	Mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	<p>GALLO GIUSEPPE MIRKO NAZARENO</p> <p>Tuesday 9:30 12:30 Studio docente, Dipartimento STEBICEF, Viale delle Scienze, Edificio 16, 90128, Palermo</p> <p>Thursday 9:30 12:30 Studio docente, Dipartimento STEBICEF, Viale delle Scienze, Edificio 16, 90128, Palermo</p> <p>PALLA FRANCO</p> <p>Monday 15:00 17:00 Studio del docente, Dipartimento STEBICEF - Sez Botanica ed Ecologia vegetale, via Archirafi 38 - I piano, 90123 Palermo</p> <p>Wednesday 15:00 17:00 Studio del docente, Dipartimento STEBICEF - Sez Botanica ed Ecologia vegetale, via Archirafi 38 - I piano, 90123 Palermo</p> <p>Friday 14:00 16:00 Studio del docente, Dipartimento STEBICEF - Sez Botanica ed Ecologia vegetale, via Archirafi 38 - I piano, 90123 Palermo</p>		

<p>PREREQUISITES</p>	<p>Students should have the knowledge acquired during the academic studies with particular reference to the teachings of the Biological and Chemical fields, as well as being able to process the information received, describing critically the possible implications</p>
<p>LEARNING OUTCOMES</p>	<p>Knowledge and understanding The course addresses morphological, functional, molecular, metabolic, biochemical, ecological and environmental concerns of microbial biology. Particular emphasis will be given to molecular aspects related to biochemical and metabolic capabilities, such as production of molecules and macromolecules of pharmaceutical, industrial and food interests, and associated with microbial biodiversity and biotechnology, also in the field of conservation of cultural asset. Understanding the nucleic acids structure, the molecular mechanisms related to DNA replication, RNA transcription and Protein translation. Recognize the in vitro – in vivo DNA duplication peculiarities. Evaluate the impact of GMO on human health, environments and biodiversity Identify and quantify the presence of trans-genes in GM plants and related products. Ability to identify specific genomic DNA sequences for studies of micro and macro biodiversity. Applying knowledge and understanding Acquisition of skills that allows to: analysis and biotechnological experiments; quality control; development of molecular tests; production of vectors and engineered systems; application of microbiological techniques as service supports to agriculture, pharmaceutical and medical researches. Analyze genetically modified micro and macro organisms, by molecular protocols. The course aims to make the student able to assimilate and critically elaborate the acquired knowledge, aimed at using molecular technologies. Judgement skills. Acquisition of skills on: evaluation and interpretation of experimental data and laboratory process also related to the safety, scientific approach in the fields of microbiology and molecular biology, closely related to the development of innovative biotechnological methods. Students are led to evaluate under a critical and responsible manner the issues addressed during the lectures and laboratory activities, as well as enrich their judgment through the reading and discussion of publications in scientific journals. Communicative abilities Acquisition of adequate knowledge and tools for scientific communication in Italian and English languages, also concerning computer skills, processing, presentation and discussion of experimental data, capability to work in team. The course aims to develop the student's ability to present ,by a clear and rigorous method, the knowledge learned. Learning ability Acquisition of adequate criteria for the deepening development of skills, as: librarian sources, access to databases and other informations on the net by bioinformatics tools. Learning progress will be monitored throughout open discussions in both classroom and laboratory. Reaching high levels of knowledge on tools and strategies for implementation of biological disciplines.</p>
<p>ASSESSMENT METHODS</p>	<p>Oral examination. The learning is assessed through an interview. In this oral examination the student must answer on the topics of the course, and they have to show an adequate knowledge, acquisition of interpretative skills, capacity of connecting and processing the arguments, as well as a relevant presentation capacity. . In addition, it evaluates the possession of an adequate technical-scientific dictionary and exposure skills. Student assessment is performed by oral exam, covering the topics of both modules: Microbiology and Molecular Biology . The final evaluation of the Integrated Course, expressed in thirty-two, is given by the weighted average of the score reached by the student in the two modules. The student passes the exam if he has at least one score of 18/30 in each test. The evaluation will be formulated as follows: 1) Basic knowledge of the topics covered and limited ability to elaborate acquired knowledge, correlation with specific application aspects for the correct conservation and restoration of cultural heritage. Sufficient ability to analyze the topics presented. Limited autonomy for judging and showing the procedures followed (rating 18-21) 2) Good knowledge of the topics covered and good skills in compiling the acquired knowledge, correlating with specific application aspects for the proper conservation and restoration of cultural heritage. Good ability to analyze the topics presented. Good autonomy for judging and showing the procedures followed (rating 22-24) 3) Extensive knowledge of the topics covered and more than good skills in the processing of acquired knowledge, correlation with specific application aspects for the correct conservation and restoration of cultural heritage. Good analysis of the arguments presented. Autonomy of judgment and exposure of the procedures followed more than good (rating 25-27).</p>

	4) Excellent knowledge of the topics covered, excellent skills in compiling the acquired knowledge, correlation with specific application aspects for the correct conservation and restoration of cultural heritage other than those of teaching. Excellent ability to analyze the phenomena presented. Excellent autonomy for judging and showing the procedures followed (rating 28-30) 5) Excellent knowledge of the topics covered, excellent ability to compile acquired knowledge, correlation with specific application aspects for the correct conservation and restoration of cultural heritage other than those of teaching. Excellent ability to analyze the phenomena presented. Excellent autonomy for judging and showing the procedures followed (vote 30 and praise).
TEACHING METHODS	Classroom lessons, Laboratory exercises.

MODULE MOLECULAR BIOTECHNOLOGIES

Prof. FRANCO PALLA

SUGGESTED BIBLIOGRAPHY

Watson JD. et al (2009) *Biologia Molecolare del gene*, VI edizione- Zanichelli
 Buchanan BB. et al (2007) *Biochimica e biologia molecolare delle piante*. Zanichelli
 Dale J., von Schantz M. (2008) *dai Geni ai Genomi*, II edizione – EdiSES
 Cox M., Nelson D. *Principi di Biochimica di Lehninger* -VII ed. Zanichelli

Articoli, dispense e protocolli tecnici (supporto cartaceo e/o informatico), Video Jove e forniti dal docente

Watson JD. et al(2016) *Molecular Biology of the Gene* VII edition -Pearson
 Palla F & Barresi (2017) *Biotechnology for Conservation of Cultural Heritage*. Springer Life Sciences

AMBIT	10643-Attività formative affini o integrative
INDIVIDUAL STUDY (Hrs)	47
COURSE ACTIVITY (Hrs)	28

EDUCATIONAL OBJECTIVES OF THE MODULE

The aims are on acquiring the cultural and technological bases both for the molecular characterization of plant biological systems, for the production of GM plants, as well as for the detection of transgenic events in vegetal matrices used for the production of food for both man and animals. Particular attention will be paid to the potential impact of GM crops on biodiversity and human health. Application of plant bioactive molecules will be evaluated.

SYLLABUS

Hrs	Frontal teaching
2	Genome organization in eukaryotic cells; animal, plant. Genomes (nuclear, mitochondrial, chloroplastic), transcriptome, proteome
2	Mechanisms of replication and transcription of eukaryotic genome. Post-transcriptional regulation In vivo – in vitro DNA duplication mechanisms and factors
2	DNA sequencing methodology: Sanger, Pyrosequencing, New Generation Sequencing, Molecular beacons Sequence analysis: dedicated software and nucleotide databases
2	Ancient DNA (aDNA): diagenesis and use for molecular investigation NGS; Pyrosequencing. The Fill-in for repairing of DNA molecules
2	Plant genetic engineering. GM plants: molecular laboratory strategies for generating modified plants. Gene transfer in plant cells: biological, physical and chemical method.
2	Vegetal matrices (mais, soy, animal feeding stuffs) detection of transgenes. QF-PCR (Syber green, Taq-man) to quantify transgenic molecules in vegetal matrices.
2	Molecular markers useful for inter-intra species analysis (ITS, DNA microsatellite, ISSR), for phylogenetic investigation
2	DNA sequences as molecular markers: nuclear, mitochondrial, chloroplast
Hrs	Workshops
4	Extraction and manipulation of genomic DNA from plant matrices: leaf, tissue, flours. Analysis of the quality and quantity of target DNA molecules.
4	Choice of target DNA sequences (molecular markers) and definition of specific primer for qualitative PCR reactions. “DNA amplificability tests” targeted on housekeeping-genes (lecithin, zein, rRNA). Multiplex PCR
4	Transgenes research in animal feed stuff, containing soybeans and corn.

**MODULE
GENERAL AND APPLIED MICROBIOLOGY**

Prof. GIUSEPPE MIRKO NAZARENO GALLO

SUGGESTED BIBLIOGRAPHY

- Biologia dei microrganismi, a cura di G. Deho' e E. Galli, Casa Editrice Ambrosiana
- Madigan M.T., Martinko J.M.: Brock. Biologia dei Microrganismi vol.1, CEA-Casa Editrice Ambrosiana, Milano.
- Schaechter M, Ingraham J, Neidhardt F.C. Microbiologia, Zanichelli ed.
- Pubblicazioni scientifiche, dispense e protocolli tecnici forniti dal docente come supporto cartaceo o informatico (Scientific papers, booklets and laboratory protocols provided as printed paper or computer files by the teacher).

AMBIT	50081-Discipline biotecnologiche con finalità specifiche: biologiche e industriali
INDIVIDUAL STUDY (Hrs)	145
COURSE ACTIVITY (Hrs)	80

EDUCATIONAL OBJECTIVES OF THE MODULE

The course addresses morphological, functional, molecular, metabolic, biochemical, ecological and environmental concerns of microbial biology. Particular emphasis is given to the biotechnological applications of specific aspects related to the biochemical and metabolic capabilities of microorganisms, such as the production of molecules and macromolecules of pharmaceutical, industrial and food interest. The molecular aspects will also be studied for the characterization of microbial biodiversity.

SYLLABUS

Hrs	Frontal teaching
2	Introduction to the history of microbiology and microbial biodiversity. Polyphasic approach for microbial classification.
8	Organization, structure and physiology of prokaryotic cells. Characteristics of the cytoplasmic membrane of prokaryotic cells. Molecular structure and function of prokaryotic cell-wall. Differential cell staining methods. Periplasmic space. Biosynthesis and characteristics of external membrane of Gram-negative bacteria. Diderm and monoderm concept.
7	Surface structures and cellular inclusions. Flagella and Pili: structure and function. Bacterial mobility and controlling molecular mechanisms thereof Capsules and EPS. S layer Consultation of scientific articles dealing with genetic aspects of extracellular structure and appendage biosynthesis.
2	Structure and function of endospores, mixospores and exospores. Process of sporulation and germination in Bacillus. Regulation of sporulation using the phosphorelay mechanism in Bacillus.
1	Eukaryotic microorganisms: yeasts, fungi and protozoa.
2	Biological and biotechnological characteristics of yeasts and molds
1	Methods of sterilization, growth media (solid, liquid, selective, enrichment), microbial strain isolation and pure cultures.
2	Microbial growth and nutritional needs. Environmental factors influencing microbial growth (temperature, pH, salinity, light, oxygen, pressure). Growth kinetics.
6	Microbial metabolism. Energy and carbon sources. General principles of metabolism: anabolism and catabolism. Oxygenic and unoxxygenic photosynthesis. Types of fermentations. Aerobic and anaerobic respiration.
6	Secondary metabolism and antibiotic biosynthesis. Classification and mechanisms of action of antibiotics. Antibiotic resistance. Streptomyces: life cycle, morphological and physiological differentiation. Strain improvement and biotechnology for the production of new antibiotics.
7	Bacteria-host interactions. Pathogenicity and virulence. Quorum sensing: Vibrio fischeri, Pseudomonas aeruginosa. Biofilms and consultation articles from scientific literature dealing with biofilm formation, structure and role concerns.
2	Secretion systems and pathogenic bacteria (Yersinia, Listeria and Legionella). Exotoxins: classificazione e meccanismi d'azione.

1	Agrobacterium tumefaciens e Bacillus thuringiensis: life cycle, characteristics, and biotechnological use.
5	General characteristics of DNA and RNA viruses. Morphology, lytic and lysogenic cycle of bacteriophages. Animal viruses in DNA and RNA: morphology and infection cycle. Viroids, virusoid and prions. Mimivirus and virophages. CRISPR systems and biotechnology applications thereof with scientific papers consultation.
2	Immunity principles and vaccines.
2	Commensalism and symbiosis between microorganisms and multicellular eukaryotic organisms. Microbiota concept. Structure and function of the human microbiota.
Hrs	Workshops
4	Methods of sterilization. Preparation of the microbial growth media.
4	Microbial cultivations. Isolation of bacteria in pure culture. Serial dilutions and counting of living bacterial cells Total cell counting.
4	Antimicrobial assays
8	Extraction and spectrophotometric quantization and characterization of biologically active metabolites produced by bacterial cultures
4	Gram staining assay