



# UNIVERSITÀ DEGLI STUDI DI PALERMO

<b>DEPARTMENT</b>	Scienze e Tecnologie Biologiche, Chimiche e Farmaceutiche		
<b>ACADEMIC YEAR</b>	2019/2020		
<b>BACHELOR'S DEGREE (BSC)</b>	BIOTECHNOLOGIES		
<b>INTEGRATED COURSE</b>	AGRICULTURAL BIOECHOLOGIES - INTEGRATED COURSE		
<b>CODE</b>	20423		
<b>MODULES</b>	Yes		
<b>NUMBER OF MODULES</b>	3		
<b>SCIENTIFIC SECTOR(S)</b>	AGR/02, AGR/03, AGR/17		
<b>HEAD PROFESSOR(S)</b>	MARRA FRANCESCO PAOLO	Professore Ordinario	Univ. di PALERMO
<b>OTHER PROFESSOR(S)</b>	MASTRANGELO SALVATORE	Ricercatore a tempo determinato	Univ. di PALERMO
	MARRA FRANCESCO PAOLO	Professore Ordinario	Univ. di PALERMO
	GIAMBALVO DARIO	Professore Ordinario	Univ. di PALERMO
<b>CREDITS</b>	12		
<b>PROPAEDEUTICAL SUBJECTS</b>			
<b>MUTUALIZATION</b>			
<b>YEAR</b>	3		
<b>TERM (SEMESTER)</b>	2° semester		
<b>ATTENDANCE</b>	Mandatory		
<b>EVALUATION</b>	Out of 30		
<b>TEACHER OFFICE HOURS</b>	<p><b>GIAMBALVO DARIO</b></p> <p>Monday 08:30 13:30 Dipartimento di Scienze Agrarie, Alimentari e Forestali. Edificio 4, Ingresso L, Piano 2°. Stanza docente. (altri giorni, online o su appuntamento)</p> <p>Tuesday 09:00 12:00 Sede del Corso di Laurea Sistemi Agricoli Mediterranei (Trapani), I semestre. Altri giorni, online o su appuntamento.</p> <p><b>MARRA FRANCESCO PAOLO</b></p> <p>Monday 09:00 11:00 Sede polo decentrato di Caltanissetta</p> <p>Tuesday 09:00 13:00 Ed. 4 H PT-98</p> <p>Thursday 09:00 13:00 Ed. 4 H PT-98</p> <p><b>MASTRANGELO SALVATORE</b></p> <p>Monday 10:00 12:00 Ed4-Ing.G-PT68</p> <p>Wednesday 10:00 12:00 Ed4-Ing.G-PT68</p>		

**DOCENTE:** Prof. FRANCESCO PAOLO MARRA

<b>PREREQUISITES</b>	Basic knowledge about: general and systematic botany; Mendelian genetics, inheritance and variations; structure and function of DNA and on genetic mutations; genetic molecular markers.
<b>LEARNING OUTCOMES</b>	<p>Knowledge and understanding: at the end of the course students will have specific knowledge concerning biotechnology applied in the areas of field, fruit crops and livestock breeding.</p> <p>Applying knowledge and understanding: the knowledge and skills' acquired will allow the student to apply in practice the conventional and innovative techniques of plant and livestock breeding (as well as propagation of field and tree crops) and process them according to specific technical requirements.</p> <p>Making judgments: students will be able to suggest the adoption of technologies and devices to improve the quantitative and qualitative level and the overall efficiency of the activities of plant and livestock breeding and plant propagation, according to the specific features of company.</p> <p>Communication skills: the student will be able to use a simple and proper language, even with stakeholders who do not have a scientific background, in presenting the development or research projects, and in addressing the plant and livestock breeders and the nurseries and seed companies</p> <p>Learning skills: the knowledge acquired will allow the student to interact with specialists in the field of plant and livestock breeding and propagation of agricultural species and to use effectively and autonomously the technical and scientific sources of the sector upgrading.</p>
<b>ASSESSMENT METHODS</b>	Learning is assessed through an oral exam which consists in an interview. The questions (usually four or five), open or semi-structured, tend to test knowledge, acquisition of interpretative skills, capacity of connecting and processing the topics, as well as a relevant presentation capacity. The final grade will be expressed in thirtieth and will be judged insufficient when the student will demonstrate: difficulty to focus on the proposed topics, a shallow knowledge of the topics and an extreme limited exposure ability. As the degree of details of the proven knowledge increase will proportionally increase the positivity of the grade. The maximum score is obtained in case of excellent mastery and critical-interpretative jurisdiction of the subject content of the course, a good exposition and the use of proper scientific terminology.
<b>TEACHING METHODS</b>	Lectures, laboratory, tutorials

**MODULE  
HERBACEOUS CROPS**

*Prof. DARIO GIAMBALVO*

**SUGGESTED BIBLIOGRAPHY**

G. Barcaccia, M. Falcinelli – Genetica e Genomica 2: Vol. 2: Miglioramento genetico. Liguori Editore.  
F. Lorenzetti, S. Ceccarelli - Genetica agraria. Patron Editore.  
E. Ciriofolo, P. Benincasa (2017) Sementi - Biologia, produzione e tecnologia. Edagricole, Milano.  
Materiale bibliografico indicato dal docente durante il corso.

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

**EDUCATIONAL OBJECTIVES OF THE MODULE**

The course aims to provide the basic elements of knowledge on: methods of reproduction and propagation of crop species; genetic structure of the variety of crop species; genetic control of traits of agricultural interest; conservation, exploitation and use of agrobiodiversity; methods to create new variability; management models of segregating generations and major conventional methods of improvement of agricultural species. Moreover, the course provides the scientific basis, standards and techniques related to the activities of the seed sector aimed at the biotechnological efficiency of the seed companies.

**SYLLABUS**

Hrs	Frontal teaching
2	Introduction to the course. Reproductive systems and propagation of cultivated species. Species that are propagated vegetatively. Species propagated by seed: mostly self- and auto-pollinated. Evaluation of the frequency of allo-pollination.
3	Introduction to population genetics. Genetic structure of populations of predominantly self-pollinating and cross-pollinating species. Hardy-Weinberg equilibrium. Inbreeding. Genetic drift. Genetic variability in natural populations.
3	Agro-biodiversity. Mechanisms of domestication and evolution of the cultivated species. Sources of natural genetic resources. Genetic erosion in the cultivated species. Methods to create new variability. Controlled pollination and intra- and interspecific hybridization. Manipulation of ploidy level. Mutagenesis. In vitro cultures and molecular biotechnologies.
6	Genetic bases of selection. Selection for traits with continuous and discontinuous variation. Main methods of plant breeding for predominantly self-pollinating and cross-pollinating species.
2	Plant variety protection. Rules for seed production and trade. Role of the seed sector within agricultural sector. GM varieties.
Hrs	Practice
3	Principles of applied statistics to biology and selection. Determining the variability due to genetic and to environmental causes.
6	Crossing procedures. Progenies growth and selection. Design and execution of plant breeding programs. Implementation of the most used schemes of conservation and multiplication of crop varieties.
3	Organization of laboratories and facilities at the seed companies.

## MODULE TREE FARMING

*Prof. FRANCESCO PAOLO MARRA*

### SUGGESTED BIBLIOGRAPHY

E. Baldini - Arboricoltura generale - Clueb  
 Biotecnologie delle colture frutticole. Sussidio didattico a cura di S. Sansavini e M. Pancaldi. Clueb Bologna.  
 References provided during the course. Lecture notes.  
 Biologia cellulare & biotecnologie vegetali Gabriella Pasqua Autori vari Piccin Editore

<b>AMBIT</b>	50080-Discipline biotecnologiche con finalità specifiche: agrarie
<b>INDIVIDUAL STUDY (Hrs)</b>	98
<b>COURSE ACTIVITY (Hrs)</b>	52

### EDUCATIONAL OBJECTIVES OF THE MODULE

Objectives of the course.

This course will provide information on the state-of-the-art of some aspects of plant biotechnology and on the opportunities, limitations, and possible development of green biotechnology applied to fruit crops breeding and propagation, with specific reference to fruit crops. Particular emphasis will be given to the importance and utilization of in vitro tissue culture for fruit crop propagation and genetic improvement.

Knowledge and comprehension skills

After the course students should have a detailed understanding of the potential deriving from application of green biotechnology to fruit crop species.

Ability to apply knowledge and comprehension

Students should be able to evaluate the opportunities offered by biotechnological tools for genetic improvement and plant propagation.

## SYLLABUS

Hrs	Frontal teaching
1	Introduction, objectives and description of the course.
2	Woody plant. Fruit crops: variety and rootstocks
2	Woody plants in the Mediterranean area.
2	Biodiversity of fruit crops.
4	Seed Propagation: Seed Production Systems. Seed-Propagated Cultivars and Species. Seed quality, collection and conservation, Dormancy, Germination, Seedling Production Systems. Vegetative Propagation: Cuttings, factors affecting rooting. Grafting, Seedling and Clonal Rootstock Systems, Graft Incompatibility, Layering, Clones, Mutations, Chimeras, Apomixis.
2	Innovative methods applied to nursery technique. Nursery industry characteristics. Genetic-sanitary certificate information.
4	In vitro morphogenesis: organogenesis, somatic embryogenesis.
3	Micropropagation: steps, objectives, methodologies, perspectives. Somaclonal variation. In vitro germplasm preservation.
2	Characterization, conservation, enhancement biodiversity.
2	Sanitation: Nucellar lines; In vitro shoot-tip grafting
2	Biotization. Synthetic seed technology.
3	Fruit crop breeding.
2	Embryo rescue.
2	Protoplast isolation, Somatic Hybridization, Cybrid production.
3	Ploidy manipulation. Haploidy Technology. Gametic Embryogenesis. Anther and isolated microspore culture. Endosperm culture.
4	Molecular markers applied to nursery and fruit crop breeding. MAS
Hrs	Workshops
12	Culture Media preparation. Explant sterilization and culture. Synthetic seed preparation. In vitro shoot-tip grafting.

**MODULE  
ZOOTECHNICS**

*Prof. SALVATORE MASTRANGELO*

**SUGGESTED BIBLIOGRAPHY**

G. Pagnacco - GENETICA ANIMALE Applicazioni Zootecniche e Veterinarie (Seconda Edizione) - Casa Editrice Ambrosiana  
G. Bittante, I. Andrighetto, M. Ramanzin - TECNICHE DI PRODUZIONE ANIMALE - Liviana Editore

<b>AMBIT</b>	10643-Attività formative affini o integrative
<b>INDIVIDUAL STUDY (Hrs)</b>	51
<b>COURSE ACTIVITY (Hrs)</b>	24

**EDUCATIONAL OBJECTIVES OF THE MODULE**

The objective of the discipline is to provide basic knowledges on major livestock species and their productive attitudes and productions. It will be deepened the genetic management of principal autochthonous livestock breeds with limited diffusion (small populations) with attention to the study of genetic variability, safeguard, genetic improvement, and traceability of their productions through modern molecular biotechnologies.

**SYLLABUS**

Hrs	Frontal teaching
4	The most important bovine, ovine and caprine breeds and their productions. Autochthonous breeds and their productions. Breed standardization and pigmentation genes: pigmentation mechanism, coat colour genes.
2	National livestock Herd Books. Selection in Italy: dairy and meat breeds.
3	Nucleid acids, structure of gene, genetic code and protein synthesis. Genic, genomic and chromosomic mutations. Genetic molecular markers.
2	Population genetics: allele and genotypic frequencies. Causes of variation of allele frequencies.
2	Genetic of quantitative traits, basic genetic model, heritability and repeatability.
4	Genetic relationship among individuals: additive relationship ( $a_{ij}$ ) and inbreeding ( $F_i$ ). Measures of relationship. Computational method of additive relationship ( $a_{ij}$ ) and inbreeding ( $F_i$ ) among individuals. The Wright's method (path-counting method) and the tabular method. Inbreeding, linebreeding, and heterosis.
2	Quantitative trait loci (QTL), major genes and their use for genomic selection.
2	Genomic selection: molecular biotechnologies for livestock studies. The DNA genotyping arrays. Linkage disequilibrium between and among loci.
3	Genomic applications: assignment of individuals to their breed of origin, identity, paternity and maternity tests, genetic traceability of livestock productions.