

Horticultural Genetics and Biotechnology

Organized by

Mediterranean Agronomic Institute of Chania

Horticultural Genetics and Biotechnology

MAI coordinator: Dr. Panagiotis KALAITZIS

Aims: The major aim of the Horticultural Genetics & Biotechnology programme is to provide the students with a thorough grounding in the mechanisms, capabilities, uses and limitations of plant biotechnological methods and available technological platforms so that they will be able to apply them to problems related to horticultural production and product quality. MSc graduates can follow an academic career in biotechnology, genetics and/or molecular biology as well as a career in agrobusinesses private sector and agricultural governmental bodies.

Objectives: The students shall:

- a) acquire specific technical skills in plant biotechnology and genetics;
- b) develop conceptual knowledge and critical thinking, hypothesis design and testing on plant biological and physiological themes pertinent to horticultural research;
- c) communicate clearly research outputs, and the rationale and knowledge underpinning these outputs;
- d) demonstrate understanding of advantages and limitations of –omics (genomics, metabolomics,) technological platforms and how are used for problem solving approaches;
- e) ability to source information;
- f) efficient use of knowledge acquired from model plants such as Arabidopsis in order to formulate research approaches for their horticultural crops of interest.

Part 1

Post graduate specialization programme

The programme is organized in 5 Units (60 ECTS)

HOB510.12110.0
03 October – 06
January, 2012

INTRODUCTION TO ADVANCED BIOLOGY (21 ECTS)

Contents:

Biochemistry.
Cell Biology.
Genetics.
Molecular Biology.
Molecular Biology Technologies (Laboratory).
Plant Molecular Biology Assignments.

Learning outcomes:

- a) knowledge of biological organization;
- b) understanding of how genetics and biology explain fundamental mechanisms of life in a cell;
- c) familiarity with key plant molecular biology techniques

HOB520.1910.0
09 January - 03
February 2012

APPLIED GENETICS (9 ECTS)

Contents:

Molecular Breeding.
DNA Fingerprinting Technology.
Genetic Association Studies.

Learning outcomes:

- a) molecular markers combined with genetic diversity assessment can be used to assist breeding approaches for crop improvement;
- b) use of molecular markers for QTL analysis.

HOB530.1904.0
06 February – 09 March
2012

ARABIDOPSIS GENETICS (9 ECTS)

Contents:

Mutant Analysis of Arabidopsis.
Principles of Arabidopsis Genetics.
Arabidopsis Transformation and Analysis of Transgenic Plants.

Learning outcomes:

- a) how complex biological questions (hormonal regulation) can be dissected using the Arabidopsis genetic tools;
- b) merging of Arabidopsis genetics and breeding.

HOB540.11210.0
12 March – 04 May 2012

POST HARVEST BIOTECHNOLOGY (9 ECTS)

Contents:

Molecular Biology of Ethylene and Fruit Ripening.
Nutritional Genomics.
CA Storage and Molecular Basis of Hypoxia.

Learning outcomes:

- a) acquisition of the particular disciplines of biochemistry, physiology and molecular biology pertinent to quality of horticultural products;

- b) integration of metabolic pathways, metabolites, gene expression and enzymatic activities in order to explain developmental changes and programmes such as ripening and senescence of horticultural crops;
- c) manipulation of developmental programmes to consumers and producers benefits;
- d) ability to 'think across' levels (molecular, cellular, tissues, organs).

HOB550.2910.0

14 March – 06 May 2011

ADVANCED BIOTECHNOLOGICAL AND -OMICS PLATFORMS (9 ECTS)

Contents:

Advanced GMO Detection Technologies (LAB).
Introduction to Bioinformatics & Systems Biology.
Micro-array Analysis.

Learning outcomes:

- a) totipotency of plant cells and their exploitation;
- b) critical appraisal of available –omics technological platforms and how can be integrated for the development of methodologies pertinent to food forensics, and GMO detection;
- c) formulation of judgements on how each platform can be used for problem solving approaches.

RETAKE EXAMS

EXAMINATIONS

Participants are obliged to take an examination in order to obtain **an individual grade for each component** in the following arrangement: For every one or two week(s) of course delivery the given examination period is one week.

All units are subject to examination.

Examinations may take the form of written exams (problems, set of questions, exercises, multiple choice questions), individual or team work project, computer assisted exams or any combination of the above forms.

Retake examination is allowed for a maximum of three weeks course delivery (**9 ECTS**) of any unit except for the final unit.

Language of instruction: ENGLISH

ACADEMIC STAFF

The academic visiting faculty of the Horticultural Genetics and Biotechnology programme is compounded by highly qualified professors from internationally renowned universities who are considered leaders in their fields. The scientific faculty of MAICH selects and invites them on the basis of specialisation to the subject matter, their international reputation and experience in teaching and research, as recognised by the academic community. MAICH is committed to the constant reviewing of the visiting faculty by the students on a yearly basis, in order to ensure the high quality of the teaching program and a dynamic adaptation to new scientific developments. Additionally, the academic visiting faculty collaborates in the formulation of research and development projects, exchange of ideas and expertise for recent advances in science and encouragement for active participation in student's MSc thesis research projects through consultation and/ or assignment of official supervising duties. Outstanding MSc MAICH graduates are subsequently recruited into their reputable PhD programs on a full scholarship basis. A considerable number of former MAICH graduates are now active and successful members of the international academic community.

Weeks	TITLE	WEIGHT	DATES
	HOB510.12110.0 Introduction to Advanced Biology 21 ECTS		03/10-16/12/2011
1	HOB511.1410.2 BIOCHEMISTRY	4	03-07/10/2011
2	EXAMS		10-14/10/2011
3	HOB512.1410.2 CELL BIOLOGY	4	17-21/10/2011
4	EXAMS		24-28/10/2011
5	HOB513.1410.1 GENETICS	4	31/10-04/01/2011
6	EXAMS		07-11/11/2011
7	HOB514.1410.2 MOLECULAR BIOLOGY	4	14-18/11/2011
8	EXAMS		21-25/11/2011
9	HOB515.1510.1 MOLECULAR BIOLOGY TECHNOLOGIES (LAB)	5	28/11-02/12/2011
10	HOB517.1009.1 PLANT MOLECULAR BIOLOGY ASSIGNMENTS	-	05-09/12/2011
11			12-16/12/2011
12	EXAM PREPARATION		19-23/12/2011
13	EXAM PREPARATION		26-30/12/2011
14	EXAMS		02-06/01/2012
	HOB520.1910.0 Applied Genetics 9 ECTS		09/01-03/02/2012
15	HOB521.1304.3 MOLECULAR BREEDING	3	09-13/01/2012
16	HOB523.1304.345 DNA FINGERPRINTING TECHNOLOGY	3	16-20/01/2012
17	HOB522.2308.2 GENETIC ASSOCIATION STUDIES	3	23-27/01/2012
18	EXAMS		30/01-03/02/2012
	HOB530.1904.0 Arabidopsis Genetics 9 ECTS		06/02-09/03/2012
19	HOB532.1304.2 MUTANT ANALYSIS OF ARABIDOPSIS	3	06-10/02/2012
20	EXAMS		13-17/02/2012
21	HOB531.1304.1 PRINCIPLES OF ARABIDOPSIS GENETICS	3	20-24/02/2012
22	HOB533.1304.1 ARABIDOPSIS TRANSFORMATION & ANALYSIS OF TRANSGENIC PLANTS	3	27/02-02/03/2012
23	EXAMS		05-09/03/2012
	HOB540.11210.0 Post-Harvest Biotechnology 12 ECTS		12/03-04/05/2012
24	HOB541.2410.3 MOLECULAR BIOLOGY OF ETHYLENE AND FRUIT RIPENING	4	12-16/03/2012
25	EXAMS		19-23/03/2012
26	HOB543.1410.1 NUTRITIONAL GENOMICS	44	26-30/03/2012
27	EXAMS		02-06/04/2012
28	EXAM PREPARATION		09-13/04/2012
29	EXAM PREPARATION		16-20/04/2012
30	HOB544.1410.1 CA STORAGE AND MOLECULAR BASIS OF HYPOXIA	4	23-27/04/2012
31	EXAMS		30/04-04/05/2012
	HOB550.2910.0 Advanced Biotechnological and -Omics Platforms		07/05-15/06/2012
32	HOB546.1304.2 ADVANCED GMO DETECTION TECHNOLOGIES (LAB)	3	07-11/05/2012
33	EXAMS		14-18/05/2012
34	HOB554.1308.1 INTRODUCTION TO BIOINFORMATICS AND SYSTEMS BIOLOGY	3	21-25/05/2012
35	HOB553.1307.1 MICRO-ARRAY ANALYSIS	3	28/05-01/06/2012
36	EXAMS		04-08/06/2012
37	RETAKE EXAMS		11-15/06/2012

HORTICULTURAL GENETICS AND BIOTECHNOLOGY PROGRAM - Academic year 2011-2012

Part 2

The Master of science program

Project (9 months duration, 60 ECTS)

All the students develop the ability to hypothesis design and testing through experimentation, to clearly communicate research outputs and ideas and to write scientific English. In addition, they become competent in a wide range of plant molecular biology and biotechnology techniques such as plant nucleic acid extractions, gene expression analysis, basic bioinformatics tools and cloning techniques, basic genetic concepts for mutants and transgenic plants analysis.

Research activities: topics generally available for Master of Science theses

- Arabidopsis genetics and hormonal regulation (ethylene);
- Role of prolyl 4 hydroxylases in plant growth and development;
- Regulation of fruit ripening and Arabinogalactans;
- Agrofood forensics and development of biotechnological methodologies for authenticity of olive and olive products and food products that cause allergies such as sesame;
- Genetic diversity assessment of horticultural crops.

INDICATIVE MASTER THESES REALIZED WITHIN THE AREA

01	Title	A study on the relation between an Arabidopsis p4h9 T-DNA insertional mutant and ethylene production and perception
	Author	Souad Mroue
	Place	Horticultural Genetics & Biotechnology Laboratory, MAICH
	Thesis Director	P. Kalaitzis
02	Title	Study of fruit size from Cucurbitaceae species using molecular, bioinformatics and engineering methods
	Author	Evangelia Vamvaka
	Place	INA Thessaloniki, Greece
	Thesis Director	Prof. A. Tsaftaris
03	Title	Involvement of the Arabinogalactan Proteins in the Anoxic and Hypoxic Response of Mature Green Tomatoes
	Author	Faten Dandachi
	Place	Horticultural Genetics & Biotechnology Laboratory, MAICH
	Thesis Director	P. Kalaitzis
04	Title	Involvement of the Arabidopsis prolyl 4 hydroxylase 9 gene in salt stress
	Author	Omar Heliel
	Place	Horticultural Genetics & Biotechnology Laboratory, MAICH
	Thesis Director	P. Kalaitzis
05	Title	A Study on the Molecular Basis of Alterations in Ethylene Production in Prolyl 4 Hydroxylase 9 T-DNA Knockout Mutant
	Author	Amel Yamoune
	Place	Horticultural Genetics & Biotechnology Laboratory, MAICH
	Thesis Director	P. Kalaitzis
06	Title	Characterization of Prolyl 4 Hydroxylases Genes Utilizing in Silico and in Vitro Approaches
	Author	Issam Rabi
	Place	Horticultural Genetics & Biotechnology Laboratory, MAICH
	Thesis Director	P. Poirazi

Detailed additional information (ECTS guide) and in particular an analytical syllabus is available at www.maich.gr/hort/