



# **Natural Products and Biotechnology**

Organized by

Mediterranean Agronomic Institute of Chania

# Natural Products and Biotechnology

Scientific coordinator: **Dr. Antonios Makris**  
MAI coordinator: **Alkinoos Nikolaidis**

## Objectives

The Master on Natural Products and Biotechnology is a two-year programme for graduates holding a university Bachelors degree in Biology, Chemistry, Agriculture, or other related sciences.

In the first year participants follow the Postgraduate Specialisation Programme. The objectives of this Programme are to: i) provide knowledge on the living systems producing secondary metabolites and their characteristic features; ii) introduce the current advances in the biosynthesis, characterization, and isolation of plant and microbial natural products, iii) provide extensive laboratory training in the genetic, computational and biochemical tools utilized in Natural Products Biotechnology; iv) enable a thorough scientific evaluation of the current and potential uses of natural products by the industry and the pharmaceutical sector.

Laboratory exercises combined with these courses provide a practical and tangible perspective. The qualified first year graduates are entitled of pursuing their research in an environment fully equipped with the most updated facilities.

In the second year, students who have successfully completed the first year develop a thesis based on research work and economic development study leading to a Master's of Science degree.

The scientific results of graduate studies are usually announced in International Conferences and/or published in World renowned journals.

# Part 1

## Postgraduate specialisation course

The programme is organized in 5 sections

### Tools

#### **ENGLISH, COMPUTERS**

It includes introductory courses on Scientific English and use of computer.

### Section 1

#### **INTRODUCTION TO ADVANCED BIOLOGY**

The section is devoted to Cell Biology, Molecular Biology and Biochemistry and Genetics courses. It aims to bring students from diverse scientific disciplines (Chemistry, Biology, Agriculture) on an equally high level of knowledge and address diverse issues such as genetics, biosynthesis, and biotechnology of Natural Products.

### Section 2

#### **CYTOLOGY AND TISSUE CULTURE**

The section is devoted to Advanced Topics in Plant Cytology and Tissue Culture Technology.

### Section 3

#### **CHEMISTRY OF NATURAL PRODUCTS**

The section is a specialized unit in Natural Products including topic in Organic Chemistry, Biochemistry of Plant Secondary Metabolism, Chemistry and Biosynthesis of terpenoids, alkaloids, flavonoids and other phenolics, extensive laboratory in the analysis of natural products and evaluation of their role in the natural environment.

### Section 4

#### **BIOTECHNOLOGY OF NATURAL PRODUCTS**

This section is a specialized unit focusing on the enzymes participating in the synthesis of Natural Products, heterologous systems of expression and large-scale production approaches.

### Section 5

#### **GENOMICS AND PROTEOMICS OF NATURAL PRODUCTS**

The section provides a comprehensive guide to the fascinating area of Plant Genomics and Proteomics, presenting an integrated, broadly accessible treatment of the complex relationship between the genome, transcriptome, and proteome of plants. This introduces the student to the range of molecular techniques applicable to investigating the unique facets of plant growth, development, and response to the environment, with emphasis to the applications related to plant secondary metabolism and the biosynthesis of natural products.

The subject includes:

Functional and structural genomics addressed within the context of natural products

- Current techniques and challenges to come
- How to utilize DNA and protein sequence data
- Practical considerations for choosing and employing the most commonly available computer applications
- A review of applications for biotechnology, including genetic modification and defence against pathogens
- Bioinformatics tools and Web resources

Numerous examples from the latest research in the field of secondary metabolism and natural products.

## TRAINING SEQUENCE

<b>Tools</b> (4 ECTS) October	<b>ENGLISH, COMPUTERS</b> <b>Unit 1</b> – Scientific english (3 ECTS), <b>Unit 2</b> – Introductory computing (1 ECTS).
<b>Section 1</b> (15 ECTS) October - November	<b>INTRODUCTION TO ADVANCED BIOLOGY</b> <b>Unit 1</b> – Cell biology (3 ECTS), <b>Unit 2</b> – Biochemistry (3 ECTS), <b>Unit 3</b> – Genetics (3 ECTS), <b>Unit 4</b> – Molecular biology (3 ECTS), <b>Unit 5</b> – Molecular biology techniques (3 ECTS),
<b>Section 2</b> (6 ECTS) December	<b>CYTOLOGY AND TISSUE CULTURE</b> <b>Unit 1</b> – Advanced topics in plant cytology (3 ECTS), <b>Unit 2</b> – Tissue culture technology (3 ECTS).
<b>Section 3</b> (18 ECTS) January - March	<b>CHEMISTRY OF NATURAL PRODUCTS</b> <b>Unit 1</b> – Topics in organic chemistry (3 ECTS), <b>Unit 2</b> – Biochemistry of secondary metabolism (3 ECTS), <b>Unit 3</b> – Chemistry of terpenoids and essential oils (3 ECTS), <b>Unit 4</b> – Chemistry of alkaloids, flavonoids and other phenolics (3 ECTS), <b>Unit 5</b> – Laboratory techniques I (3 ECTS), <b>Unit 6</b> – Laboratory techniques II (3 ECTS).
<b>Section 4</b> (15 ECTS) March – April	<b>BIOTECHNOLOGY OF NATURAL PRODUCTS</b> <b>Unit 1</b> – Enzyme structure and function (3 ECTS), <b>Unit 2</b> – Techniques in biochemical analysis (3 ECTS), <b>Unit 3</b> – Ecological and stress biochemistry (3 ECTS), <b>Unit 4</b> – Bioinformatics and applications in secondary metabolism (3 ECTS), <b>Unit 5</b> – Industrial biotechnology (3 ECTS).
<b>Section 5</b> (6 ECTS) May	<b>GENOMICS AND PROTEOMICS OF NATURAL PRODUCTS</b> <b>Unit 1</b> – Genomics and proteomics of natural products (3 ECTS), <b>Unit 2</b> – Genomics and proteomics of natural products (3 ECTS).



## **Comprehensive oral or written examination (Modalities and dates)**

During Introduction, participants attend classes on English TOEFL and Computers. They are also obliged to attend a 45-hour course in Scientific English, equally distributed during sections, and take a written examination.

Participants take written examinations or submit projects for every unit within one section in the exam week which is scheduled at the end of every section, each unit being independently graded. Written exams consist of a set of questions that require a concise answer. Some of the questions are multiple choices. Lengthy questions are avoided.

Participants have the option of retaking course examinations of their preference equivalent of 9 ECTS credits during a weeklong retake period. There is no retake examination period for the last section.

A comprehensive oral examination conducted by an Examination Board takes place at the end of the academic year, representing 15% of the total grade.

## **Analytical syllabus**

### **Tools**

### **ENGLISH, COMPUTERS**

#### **Unit 1 – Scientific english**

Note-taking skills in order to better understand lectures; the study of scientific texts and their development; terminology related to the students' chosen field; a review of the fundamentals of English grammar with a view to studying advanced grammar skills for the purposes of writing a M.Sc. thesis; development of academic writing skills; public speaking, communication skills and theme-related discussions based on the students' chosen field of study. The final grade is awarded on the basis of the following:

- examination marks (based on grammar and scientific texts);
- presentation marks (based on oral and written presentations of students' own work);
- participation in classwork and attendance; homework assignments.

#### **Unit 2 – Introductory computing**

Computer hardware components, peripherals and controllers; architecture; operating systems. Interacting with computers. Data communications and computer networks. The Internet; brief history, protocols, addressing and domain name service (DNS). E-mail, News-Groups, Telnet, Ftp, WWW (World Wide Web). Computer applications; word processing, spread-sheets, data-bases, graphics, scientific software, schedules. Computer Security.

## Section 1

## INTRODUCTION TO ADVANCED BIOLOGY

### Unit 1 – Cell biology

Eukaryotic versus prokaryotic cells. Cell structure and compartmentation. Cell membranes and their principles. Cell organelles and their physiology. Intracellular and intercellular communication. Genetic information storage-nucleus. Nuclear cytoplasmic interactions. Cell specialization – animal and plant cells. Cell responses to environmental stimuli.

### Unit 2 – Biochemistry

Water, solvent of life; Properties of solutions; buffers. Biological macromolecules; (proteins, nucleic acids, polysaccharides, lipids).

#### Proteins:

Levels of protein organization, Protein interactions, Cell environment factors controlling protein assembly, Protein synthesis, Post-translation modifications, Protein compartmentation, Protein stability and turnover, Multiple functional stages of proteins, Multiplicity of protein forms and functions, Plant and insect hormones and their receptors

#### Polysaccharides:

Cell surface diversification, Cell adhesion, Natural products

#### Lipids:

Simple and complex lipids, Lipoproteins, Lipid messengers

#### Nucleic acids:

(See molecular biology).

### Unit 3 – Genetics

Historical perspective of Genetics. Early genetic experiments. Experimental derivation of the laws of inheritance/ Mendel. Critical experiments in the development of Genetics. Chromosome theory of inheritance. The unit of heredity. The nature of the gene; Cistrons. Position effects of DNA (McClintock's work). Gene synthesis. Genetic engineering. Impact of Genetics on Society.

### Unit 4 – Molecular biology

Stereochemistry of DNA and DNA topology. DNA replication, In vitro genetics. Restriction enzymes. Transcription factors. Transcriptional machineries. Pleiotropic effects of transcription. The substrate of transcription (chromatin). Role of introns-exons. Post transcriptional regulation. Post translational regulation. Differential gene expression and chromosomal domains. Extranuclear DNA. Environmental effects of gene expression.

### Unit 5 – Molecular biology techniques

Aseptic techniques; media preparation;  
Subculturing of bacteria, dilution, replica plating, storage;  
Bacterial transformation with plasmids. Chemical transformation;  
electroporation;  
Isolation of plasmid DNA; digestion of plasmid DNA;  
Electrophoresis of DNA;  
Polymerase Chain Reaction;  
Plant DNA extraction, techniques and problems;  
DNA hybridisation using radioactive probes PCR;  
Expression vectors.

## Section 2

### CYTOLOGY AND TISSUE CULTURE

#### Unit 1 – Advanced topics in plant cytology

The compartmentation of the plant cell. Morphometric assessment of the cell structural elements. The biomembrane (fluid mosaic, active transport, fusion, potential, endo/exocytosis). The cytoskeleton (microtubules, actin filaments, intermediate filaments). Ribosomes and protein synthesis. The endomembrane system (fine structure of the Golgi apparatus and the endoplasmic reticulum, transport of glycoproteins, dynamic membrane flow, microbodies with specific functional activities). Organization of the interphase nucleus, cell division. Structural composition of the cell fundamental energy centers (mitochondria) and their implication in the process of respiration. Types of plastids and their participation in specific intracellular procedures. Fine structure of the chloroplasts in regards to the course of photosynthesis. The vacuoles as osmotic, depository and lytic sites of the plant cell. The cell wall (membrane rosettes and genesis of cellulose microfibrils, the skeletal lattice, mechanism of microfibril orientation, thickening of the cell wall, plasmodesmata, functional activities).

#### Unit 2 – Tissue culture technology

Aseptic techniques, Media preparation, Callus induction, Plant regeneration, Cell suspension cultures. Seed production procedures. Production and propagation material in of vegetatively propagated crops. Use of tissue culture and transformation in plant propagation and genetic engineering. Genetic engineering in plant breeding. Genetic improvement of vegetatively propagated crops.

## Section 3

### CHEMISTRY OF NATURAL PRODUCTS

#### Unit 1 – Topics in organic chemistry

This course aims to provide students coming from a wide range of disciplines (biology, agriculture, microbiology, biochemistry, physiology) with a comprehensive understanding of the basic concepts of organic chemistry. The course is designed to introduce the students to the principles of organic reactions and reaction mechanisms particular to the synthesis and analysis of natural products. The rational design and synthesis of novel compounds with desired properties based on natural products and the application of combinatorial chemistry are other aspects of this course.

#### Unit 2 – Biochemistry of secondary metabolism

Introduction to plant metabolism. Plant structure and cell structure. Chemical nomenclature, the logic of metabolism and reaction mechanisms. Building blocks-biosynthetic pathways. Shikimate, mevalonate, methylerythritol phosphate pathway, glyceraldehyde-3-phosphate/ pyruvic acid pathway.

Important secondary metabolite groups: Fatty acids and polyketides, phenylpropanoids and lignin, terpenoids and steroids, tropane alkaloids, terpenoid indole alkaloids.

Gene regulation in secondary metabolism. Tissue specificity (phenylpropanoids) and stress responsiveness (terpenoid indole alkaloids). Compartmentation, storage and transport.

### **Unit 3– Chemistry of terpenoids and essential oils**

Fragrance and flavouring compounds : essential oils, terpenoids-oleoresins- Detailed biochemical pathways for the production of volatile compounds in specific plant species; Chemical structure, distribution, diurnal and seasonal fluctuations; Intraspecific differences in volatiles oil production, differentiation between geographical origins; Turpentine and terpene industry and, biological activity).Raison d'être.

### **Unit 4 – Chemistry of alkaloids, flavonoids and other phenolics**

Pharmacological action of alkaloids : Pyridine-piperidine alkaloids, Tropane alkaloids, quinoline alkaloids, isoquinoline alkaloids, indole alkaloids, imidazole alkaloids, steroidal alkaloids. Detailed biochemical pathways for the production of alkaloids in specific plant species. Chemical structures, subcellular localization, distribution and evolution in gymnosperms and angiosperms, biological activity & role of alkaloids in plants.Detailed biochemical pathways for the production of flavonoids in specific plant species. Chemical structures, subcellular localization, natural distribution and evolution in gymnosperms and angiosperms. Biological activity: role of flavonoids in plants, Natural pigments:anthocyanins-flavonoids-other phenolic compounds and other miscellaneous natural pigments.

### **Unit 5 – Laboratory techniques I**

Theory of chromatography, instrumental techniques (GC, HPLC) and applications, principles of mass spectroscopy and applications (LC-MS, GC-MS), principles of photospectroscopy, other spectroscopic methods (IR, NMR), identification, quantitation, structural determination, laboratory exercises.

### **Unit 6 – Laboratory techniques II**

Theory of chromatography, instrumental techniques (GC, HPLC) and applications, principles of mass spectroscopy and applications (LC-MS, GC-MS), principles of photospectroscopy, other spectroscopic methods (IR, NMR), identification, quantitation, structural determination, laboratory exercises.

## **Section 4**

### **BIOTECHNOLOGY OF NATURAL PRODUCTS**

#### **Unit 1 – Enzyme structure and function**

Enzymes are fundamental to all life. Without proteinaceous catalysts the chemistry of life would simply not occur. They are supremely efficient catalysts and are capable of exquisite feats of molecular recognition. They are responsible for the biosynthesis of natural products and they form the molecular targets of compounds with pharmacological properties. For these reasons they are of prime importance to the biotechnology of natural products. Moreover, much of modern biotechnology is involved with the production and use of proteins. Enzymes, not only are important to the pharmaceutical industry, but also are relevant to food and plant biotechnology. To the former, they are sources of novel functionality in the complex systems that make up food, whilst to the latter, they are the target of rational strategies to redesign the properties of crop plants. This module is aimed at students with a range of backgrounds and is designed to provide the knowledge base and intellectual framework for more advanced studies of particular relevance to Natural Products and Biotechnology.

## **Unit 2 – Techniques in biochemical analysis**

This laboratory-based course covers the basic techniques of protein expression, purification and characterisation. These include: Production of recombinant proteins in bacteria, cell lysis, gel-filtration chromatography, ion-exchange chromatography, affinity chromatography, hydrophobic interaction chromatography, SDS-PAGE, isoelectric focusing, Western blotting, determination of protein concentration and enzyme activity assays.

## **Unit 3 – Ecological and stress biochemistry**

Biosynthesis of secondary compounds in plants. Control mechanisms; biochemistry and molecular basis. Ecological role of plant secondary metabolites. Biochemistry of plant pollination (flower colour, flower scent). The role of secondary compounds in plant-pollinator interactions. The role of secondary compounds in plant-herbivore interactions (insects, vertebrates, fungi). Plant toxins and their effects on animals (cyanogenic glycosides, cardiac glycosides), The cost of resistance to herbivores. Animal pheromones and defence substances (insect pheromones, mammalian pheromones, defence substances). Effects of higher plants on micro-organisms mediated by plant secondary compounds (Phytoalexins, Phytotoxins), plant-plant biochemical interactions (inhibition of seed germination, allelopathy). Environmental and genetic control of nitrogen assimilation in relation to secondary metabolism.

## **Unit 4 – Bioinformatics and applications in secondary metabolism**

The course aims to introduce the basic tools used in computational biology for analyzing genes, proteins and metabolic pathways. The topics include: Introduction to the GenBank sequence database; Structure databases; Information retrieval from biological databases; tools for DNA sequence analysis, multiple sequence alignment; tools for protein analysis, protein linkage-maps; constructing phylogenetic trees; Introduction to metabolic pathways; mining data for understanding secondary metabolism. The course is inclusive of all the modern approaches that enable scientists to establish genetic relationships, construct phylogenetic trees, dissect secondary metabolic pathways and understand basic concepts of structure-function relationships of the enzymes involved in secondary products formation.

## **Unit 5 – Industrial biotechnology**

This course is designed to familiarise the students with the methods used to produce compounds of high commercial value in the Biotechnological Industry. The course will cover the following topics: Bioprocessing (Microorganisms with biotechnological interest, Bioreactors for microorganisms, Criteria of biotechnological processes), Industrial applications of recombinant technology, Purification of proteins (recombinant, membrane-bound, antibodies, pharmaceutical proteins etc), Protein engineering of enzymes with biotechnological interest, Regulatory mechanisms of biosynthetic enzymes (Metabolic engineering), Immobilization of enzymes, coenzymes and cells, Downstream processing, Sterilization, Bioreactors (Types of Bioreactors, Designing of Bioreactors, Enzymes for Bioreactors), Examples of Biotechnological processes (Production of pharmaceutical proteins and vaccines, Production of polysaccharides and aromatic compounds, Production of biodegradable polymers, Monoclonal Antibodies, Other biotechnological applications).

## Section 5

### GENOMICS AND PROTEOMICS OF NATURAL PRODUCTS

#### Unit 1 – Genomics and proteomics of natural products

- Functional and structural genomics addressed within the context of natural products
- Current techniques and challenges to come
- How to utilize DNA and protein sequence data
- Practical considerations for choosing and employing the most commonly available computer applications
- A review of applications for biotechnology, including genetic modification and defence against pathogens
- Bioinformatics tools and Web resources

Numerous examples from the latest research in the field of secondary metabolism and natural products

#### Unit 2 – Genomics and proteomics of natural products

- Yeast biology, an overview
- Methods in yeast genetics
- Yeast genomics and proteomics
- Yeast as a model organism to study fundamental biological processes
- Yeast biotechnology: an industrial workhorse?

A course unit composed of lectures and lab work on yeast biology, genetics and biotechnology.

## Part 2

### The Master of Science thesis

#### Project (9 month duration, 60 ECTS)

Topics generally available for Master of Science thesis:

- Isolation and characterisation of the components of the cellular machinery involved in the biosynthesis of natural products (terpenoids, flavonoids etc.).
- Biotechnological production of natural products by the means of in vitro (bio-reactor) or in vivo (cell factory) reconstitution of the biosynthetic pathway.
- Manipulation and genetic engineering of plant secondary metabolism to yield plants with improved production characteristics.
- Engineering of plant resistance to biotic (pathogen) and abiotic (drought, chill) stress through manipulation of the secondary metabolism

#### INDICATIVE MASTER THESES REALIZED WITHIN THE AREA

**TITLE:** Structural, functional and mechanistic studies of terpene synthases (2008)

**AUTHOR:** Walid Mahrez, Algeria

**PLACE OF REALIZATION:** Department of Natural Products and Biotechnology, Mediterranean Agronomic Institute of Chania, Greece

**THESIS DIRECTOR:** Sotirios Kampranis, Christopher Johnson

**TITLE:** Molecular basis of the biodiversity of the essential oil production in *Salvia* sp. (2008)

**AUTHOR:** Ederina Ninga, Albania

**PLACE OF REALIZATION:** Department of Natural Products and Biotechnology, Mediterranean Agronomic Institute of Chania, Greece

**THESIS DIRECTOR:** Sotirios Kampranis

**TITLE:** Investigation of the peroxidase activity and chaperone function of LeTpx, an atypical 2-Cys peroxidase from tomato (2008)

**AUTHOR:** Chirine Toufaily, Lebanon

**PLACE OF REALIZATION:** Department of Natural Products and Biotechnology, Mediterranean Agronomic Institute of Chania, Greece

**THESIS DIRECTOR:** Sotirios Kampranis, Doris Fink

**TITLE:** Investigation of the interaction of DNA topoisomerases with the transcription machinery (2008)

**AUTHOR:** Ayad Awad Amer, Egypt

**PLACE OF REALIZATION:** Department of Natural Products and Biotechnology, Mediterranean Agronomic Institute of Chania, Greece

**THESIS DIRECTOR:** Sotirios Kampranis

**TITLE:** Cloning, purification, expression and analysis of *E. coli* Cyrase A and B (2008)

**AUTHOR:** Lilit Cagiki Stepanyan, Armenia

**PLACE OF REALIZATION:** Department of Natural Products and Biotechnology, Mediterranean Agronomic Institute of Chania, Greece

**THESIS DIRECTOR:** Sotirios Kampranis

**TITLE:** Screening of cDNA libraries from glandular trichomes of *Salvia fruticosa* and *Salvia pomifera* by colony-low stringency hybridization to identify terpene synthase genes (2007)

**AUTHOR:** Sebastian Owskiak, Poland

**PLACE OF REALIZATION:** Department of Natural Products and Biotechnology, Mediterranean Agronomic Institute of Chania, Greece

**THESIS DIRECTOR:** Sotirios Kampranis, Christopher Johnson

**TITLE:** The involvement of DNA topoisomerases in cytokinesis  
**AUTHOR:** Said Idboubker, Morocco  
**PLACE OF REALIZATION:** Department of Natural Products and Biotechnology, Mediterranean Agronomic Institute of Chania, Greece  
**THESIS DIRECTOR:** Sotirios Kampranis

**TITLE:** Screening for plant proteins interacting with bacterial and plant topoisomerases using the yeast two hybrid system (2007)  
**AUTHOR:** Mourad Maza, Algeria  
**PLACE OF REALIZATION:** Department of Natural Products and Biotechnology, Mediterranean Agronomic Institute of Chania, Greece  
**THESIS DIRECTOR:** Sotirios Kampranis, Suzanna Scott-Drew

**TITLE:** Antagonistic roles of old yellow enzymes (OYE) in oxidative stress and programmed cell death in yeast (2007)  
**AUTHOR:** Osama Odat, Jordan  
**PLACE OF REALIZATION:** Department of Natural Products and Biotechnology, Mediterranean Agronomic Institute of Chania, Greece  
**THESIS DIRECTOR:** Antonios Makris

**TITLE:** Phytochemical investigation of flavonoid constituents of *Fortunella margarita* (kumquat) cultivated in Corfu-Greece (2007)  
**AUTHOR:** Husam Walid Ibrahim Aroud, Syria  
**PLACE OF REALIZATION:** Department of Food Quality and Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Greece  
**THESIS DIRECTOR:** Eugenios Kokkalou

**TITLE:** A potential involvement of the plant ENT domain in chromatin structure and remodeling  
**AUTHOR:** Mustafa Taleb Ardah, Jordan (2006)  
**PLACE OF REALIZATION:** Department of Natural Products and Biotechnology, Mediterranean Agronomic Institute of Chania, Greece  
**THESIS DIRECTOR:** Sotirios Kampranis, Suzanna Scott-Drew

**TITLE:** Investigation of binding and stress-protective functions of LeTPX1, a tomato thioroedoxin 2-Cys peroxidase (2006)  
**AUTHOR:** Abedalkarim Tanina, Palestine  
**PLACE OF REALIZATION:** Department of Natural Products and Biotechnology, Mediterranean Agronomic Institute of Chania, Greece  
**THESIS DIRECTOR:** Antonios Makris, Sotirios Kampranis

**TITLE:** Novel developments in luminal chemiluminescence: Application of the luminal/Co(II)-EDTA and luminal/hemin systems on oils (2006)  
**AUTHOR:** Siham Bezzi, Algeria  
**PLACE OF REALIZATION:** Department of Food Quality Management and Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Greece  
**THESIS DIRECTOR:** Anthony C. Calokerinos, Panagiotis Kefalas

**TITLE:** Studies on the biological and biochemical properties of a *Salvia fruticosa* isoflavone reductase homologue (2005)  
**AUTHOR:** Mohamed Abd El Ghani Ali El Sayed, Egypt  
**PLACE OF REALIZATION:** Department of Natural Products & Biotechnology, Mediterranean Agronomic Institute of Chania, Greece  
**THESIS DIRECTOR:** Antonios Makris, Sotirios Kampranis

**TITLE:** Functional expression in-vitro and biochemical characterization of terpene synthases of *Salvia fruticosa* (2005)

**AUTHOR:** Samir Anssour, Algeria

**PLACE OF REALIZATION:** Department of Natural Products & Biotechnology, Mediterranean Agronomic Institute of Chania, Greece

**THESIS DIRECTOR:** Christopher Johnson, Sotirios Kampranis

**TITLE:** Transposon tagging in yeast to identify genes involved in resistance to bax lethality (2005)

**AUTHOR:** Samer Matta, Lebanon

**PLACE OF REALIZATION:** Department of Natural Products & Biotechnology, Mediterranean Agronomic Institute of Chania, Greece

**THESIS DIRECTOR:** Antonios Makris

**TITLE:** Environmental and ontogenic variation of terpene biosynthesis (2005)

**AUTHOR:** Mohamed Sadok Ennaifer, Tunisia

**PLACE OF REALIZATION:** Department of Natural Products & Biotechnology, Mediterranean Agronomic Institute of Chania, Greece

**THESIS DIRECTOR:** Christopher Johnson

**TITLE:** Differential roles of glutathione S-Transferases in oxidative stress (2005)

**AUTHOR:** Nicolas Clatot, France

**PLACE OF REALIZATION:** Department of Natural Products & Biotechnology

**THESIS DIRECTOR:** Sotirios Kampranis

**TITLE:** Flavonoid composition of Greek honey. Qualitative and quantitative variation among pine honey samples from different geographical areas of Greece (2005)

**AUTHOR:** Farid Aboud, Algeria

**PLACE OF REALIZATION:** Department of Food Quality Management and Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Greece

**THESIS DIRECTOR:** Panagiotis Kefalas

**TITLE:** Chemical investigation of the volatile metabolites of species of the genus *Rosa* growing in the Lebanon (2005)

**AUTHOR:** Dominique Choueiter, Lebanon

**PLACE OF REALIZATION:** Department of Food Quality Management and Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Greece

**THESIS DIRECTOR:** Vassilios Roussis

**TITLE:** A study on the antioxidant properties of Mediterranean algae: preliminary chemical investigation of the sea grass *Posidonia oceanica* (2005)

**AUTHOR:** Raluca Alexandra Stoiculescu, Romania

**PLACE OF REALIZATION:** Department of Natural Products & Biotechnology, Mediterranean Agronomic Institute of Chania, Greece

**THESIS DIRECTOR:** Vassilios Roussis

## **REFERENCES OF THE MAIN ACADEMIC STAFF TEACHING WITHIN THE M.SC. PROGRAMME**

More than 25 invited lecturers from about 4 countries participate in each edition of the M.Sc. programme of which, 20% came from Research Institutes, 74% from Higher Education Institutions, 6% from Private Companies. Considering their implication in the programme, the following academic staff is taken as reference:

### **AUSTRIA**

#### **Higher Educational Institutions**

- Johannes Novak. Veterinary University of Vienna, Vienna

### **GREECE**

#### **Higher Education Institutions**

- Konstantinos Vlachonasios. Aristotle University of Thessaloniki, Thessaloniki
- Athanasios Tsaftaris. Aristotle University of Thessaloniki, Thessaloniki
- Dimitrios Voyatzis, Aristotle University of Thessaloniki, Thessaloniki
- Artemios Bozabalidis. Aristotle University of Thessaloniki, Thessaloniki
- Elias Couladouros. Agricultural University of Athens, Athens
- Vassilios Roussis. University of Athens, Athens
- Eugenios Kokkalou. Aristotle University of Thessaloniki, Thessaloniki
- Dimitrios Kyriakidis. Aristotle University of Thessaloniki, Thessaloniki

#### **Research Institutes**

- K. Sekeris. National Research Institute, Athens
- Dimitrios Kafetzopoulos. Institute of Molecular Biology and Biotechnology, Heraklion
- Panagiotis Kanellopoulos, Laikon Hospital, Biochemistry Laboratory, Athens
- Anastasia Detsi. Institute of Organic and Pharmaceutical Chemistry, Athens
- D. Tzamarias. Institute of Molecular Biology and Biotechnology, Heraklion