

MEDITERRANEAN AGRONOMIC INSTITUTE OF CHANIA
(MAICH)

*Food Quality Management and Chemistry
of Natural Products*

POSTGRADUATE ACADEMIC GUIDE

&

ECTS GUIDE

2006 - 2007

Food Quality Management and Chemistry of Natural Products

Postgraduate Specialisation and M.Sc. Programme

SCIENTIFIC COORDINATOR: **Dr. Panagiotis Kefalas**

EDUCATIONAL AND PROFESSIONAL GOALS

The Master on Food Quality Management and Chemistry of Natural Products provides a two-year programme for graduates holding a University Bachelors' degree in Chemistry, Agriculture, or other related sciences.

In the first year participants follow the Postgraduate Specialisation Course. The objectives of this Course are to: i) provide advanced knowledge in the areas of food chemical composition and food microbiology; ii) introduce indispensable notions of quality and safety in all levels of production of food or other products; iii) present current advances for the isolation, characterisation and application of natural products in the industry; iv) provide laboratory experience in food and natural product analysis; v) merge quality assurance requirements with the development, processing, preservation and packaging of edible products.

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 leading to a Master's of Science degree.

The scientific results of graduate studies are usually announced in International Conferences and/or published in International Peer Review Scientific Journals

POST GRADUATE SPECIALISATION PROGRAMME

The programme is organised in 5 sections

Section I - Introductory Discipline

The cycle includes introductory courses on Scientific English, use of Computer and Statistics.

Section II - Fundamental Overviews

The cycle intends to strengthen the background of the students in order to form a solid base, upon which the rest of the course will be based. It includes: an overview of organic and analytical chemistry and the indispensable statistics and uncertainty evaluation as tools.

Section III - Advanced Food Chemistry

The cycle is devoted to a detailed study of advanced themes in food chemistry and chemical analysis. The very important topic, nowadays, on functional foods is included, together with food microbiology.

Section IV - Chemistry of Natural Products

The cycle focuses on the chemistry of natural products, as viewed through the study of specific families (alkaloids, terpenoids, flavonoids) and the laboratory techniques used for their isolation, identification and analysis. Their biosynthetic and metabolic paths are also included.

Section V - Topics in Food Sciences

The cycle focuses on other aspects of food production with reference to safety, preservation, quality assurance, legislation and chemical approach to the identification of specific origin.

TRAINING SEQUENCE

Section I - Introductory Discipline [7 ECTS]

from October to November

- FQC.501 - Scientific English (3 ECTS)
- FQC.502 - Introductory Computing (1 ECTS)
- FQC.503 - Statistical Procedures (3 ECTS)

Section II - Fundamental Overviews [6 ECTS]

November

- FQC.511 - Organic Chemistry (3 ECTS)
- FQC.512 - Analytical Chemistry I (3 ECTS)

Section III - Advanced Food Chemistry [18 ECTS]

from November to February

- FQC.521 - Foods/Lipids/Antioxidants (3 ECTS)
- FQC.522 - Water Relations in Food - Food Carbohydrates (3 ECTS)
- FQC.523 - Food Microbiology (3 ECTS)
- FQC.524 - Food Protein and Enzymes (3 ECTS)
- FQC.525 - Analytical Chemistry II (3 ECTS)
- FQC.526 - Functional Foods and Bioactive Ingredients (3 ECTS)

Section IV - Chemistry of Natural Products [15 ECTS]

from February to March

- NPB.522 - Biochemistry of Secondary Metabolism (3 ECTS)
- NPB.523 - Chemistry of Terpenoids and Essential Oils (3 ECTS)
- NPB.524 - Chemistry of Alkaloids, Flavonoids and Other Phenolics (3 ECTS)
- FQC.534 - Laboratory Techniques I (3 ECTS)
- FQC.535 - Laboratory Techniques II (3 ECTS)

Section V - Topics in Food Sciences [18 ECTS]

from March to June

- FQC.541 - New Concepts in Food Packaging (3 ECTS)
- FQC.542 - Trends in Food Processing-Preservation Technologies (3 ECTS)
- FQC.543 - Food Product Development & Predictive Modeling of Food Quality (3 ECTS)
- FQC.544 - Food Legislation (3 ECTS)
- FQC.545 - Products of Appellation of Origin (3 ECTS)
- FQC.546 - Quality Assurance (3 ECTS)

ANALYTICAL SYLLABUS

FQC.501 - **Scientific English** (3 ECTS) _____

LECTURER: Mrs Linda Lucas

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: The development of scientific writing and communication skills.

PREREQUISITES: Good knowledge in English language.

COURSE CONTENTS

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.

RECOMMENDED READING

Papers provided by the instructor.

ASSESSMENT METHODS: Written exam, Project Presentation

FQC.502 - **Introductory Computing** (1 ECTS) _____

LECTURER: Mr. Nicolas Boretos

TYPE OF COURSE AND TEACHING METHODS: Computer-assisted teaching

OBJECTIVE OF THE COURSE: Introduce scientists to the computer-based resources available.

PREREQUISITES:

COURSE CONTENTS

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, schedulers. Computer Security.

RECOMMENDED READING

European Computing Driving Licence.

ASSESSMENT METHODS: Written exam, Computer-Assisted Exam

FQC.503 - **Statistical Procedures** (3 ECTS) _____

LECTURER: Prof. A. Papadopoulos

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Basic concepts and theories in statistics.

PREREQUISITES: Fundamentals of statistics.

COURSE CONTENTS

Descriptive statistics, frequency distributions measures of central tendency and dispersion.
Probability distributions: Binomial, Hypergeometric, Poisson, Normal, X², Student-t and F. Statistical inference: estimation and hypothesis testing. Simple and multiple regression.

RECOMMENDED READING

Power Point Presentation, notes provided.

ASSESSMENT METHODS: Written exam

FQC.511 - **Organic Chemistry** (3 ECTS) _____

LECTURER: Dr. Anastasia Detsi

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Strengthen the background of the students and provide advanced knowledge in organic chemistry, which is one of the indispensable tools in the field of natural products.

PREREQUISITES: Knowledge of fundamentals in chemistry, undergraduate organic chemistry.

COURSE CONTENTS

Nomenclature, reactions, mechanisms, stereochemistry, asymmetry, families of compounds that are encountered in food chemistry, laboratory practice.

RECOMMENDED READING

Organic Chemistry by T. Solomon.

Organic Chemistry by J. McMurry, Publisher Brooks Cole; 6th Edition, 2003.

Power Point Presentation, notes provided.

ASSESSMENT METHODS: Written exam

FQC.512 - **Analytical Chemistry I** (3 ECTS) _____

LECTURER: Prof. Antonios Calokerinos

TYPE OF COURSE AND TEACHING METHODS: Lectures, Laboratory, Computer-assisted teaching

OBJECTIVE OF THE COURSE: Strengthen the background of the students and provide advanced knowledge in analytical chemistry.

PREREQUISITES: Knowledge of fundamentals in chemistry, undergraduate analytical chemistry.

COURSE CONTENTS

Chemical equilibrium, buffers, complexes, titrations, redox potential, laboratory practice.

RECOMMENDED READING

Fundamentals of Analytical Chemistry, Douglas A., Skoug F., James Holler, Donald M. West.

Analytical Chemistry, Gary D. Christian.

Quantitative Chemical Analysis, Daniel C. Harris.

Power Point Presentation, notes provided.

ASSESSMENT METHODS: Written exam, Project Presentation

FQC.521 - **Foods/Lipids/Antioxidants** (3 ECTS) _____

LECTURER: Prof. Dimitrios Boskou

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Provide advanced knowledge in the field of lipids and their function, as well as in the field of antioxidants.

PREREQUISITES: Undergraduate food chemistry.

COURSE CONTENTS

Chemistry of oils and fats, free radical chemistry, reactive oxygen, photosensitised oxidation, metal catalysed reactions. Antioxidants: chemistry and mechanisms of action, techniques of evaluation of antioxidant activity, uses.

RECOMMENDED READING

Chemical and Functional Properties of Food Lipids, A. E. Sikorski, Edit., CRC Press Boca Rn, 2003.
Steinhart H. and Blemoth, G., Lipids in Novel Foods, Eur. J. Lipid Sci Technol., 2001, 103, 40-41.
Fennema, O. R., Food Chemistry, Marcel Dekker Inc, N.Y., 1985.
Boskou, D., Olive Oil, Chemistry and Technology, AOCS Press, Champaign Illinois, 1996.
Pokorny, J. Yanishlieva N. and M. Gordon, Antioxidants in Food, CRC Press, Boca Raton, 2001.
Bidlack, W. R., Phytochemicals. A new Paradigm, Technomic Publ Co, Lancaster, 1998.

ASSESSMENT METHODS: Written exam

FQC.522 - Water Relations in Food - Food Carbohydrates (3 ECTS) _____

LECTURER: Prof. Constantinos Biliaderis

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Provide advanced knowledge in the understanding of interactive mechanisms between water and carbohydrates in food.

PREREQUISITES: Undergraduate food chemistry.

COURSE CONTENTS

Water relationships in foods: water activity and its relevance to deteriorative processes in foods (chemical, enzymic, physical and microbial changes). Glass transitions and molecular mobility in foods, their relevance to quality and stability of food products. State diagrams and strategies to enhance quality and shelf life of food systems. Food Carbohydrates: structural, analytical, physicochemical, nutritional and functional aspects of small mol. wt. carbohydrates and polysaccharides of plant and microbial origin.

RECOMMENDED READING

Modified Starches in Foods (1983), E. Trimble, Journal of Consumer Studies and Home Economics, 7, 247-260,
Glass transitions and product stability-an overview(1995), Food Hydrocolloids, Vol. 9 no. 4, p. 307-315.
The structure and interactions of starch with food constituents (1991), J. Physiol. Pharmacol. 69: 60-78.
Fat Replacers, (1998), Casimir C. Akoh, Food Technology, Vol. 52, no 3.
Water Activity in Foods: G. B. Barbarosa-CAnovas, A. J. Fontana, S. Schmidt, T. P. Labuza, 2004, Blackwell Publishing.
Polysaccharide Association Structures in Food, 1998, R. H. Walter, Marcel Dekker, Inc.
Food Chemistry, 3rd Edition, O. R. Fennema, 1996, Marcel Dekker (paper cover).

ASSESSMENT METHODS: Written exam

FQC.523 - Food Microbiology (3 ECTS) _____

LECTURER: Dr. Zeina Kassaify

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Provide advanced knowledge in food microbiology

PREREQUISITES: Undergraduate food chemistry and/or basics of biology.

COURSE CONTENTS

Microbial growth in food: intrinsic, extrinsic and implicit factors. Microbial interactions. Inorganic, organic and antibiotic additives. Effects of enzymes and other proteins. Combination systems. Adaptation phenomena and stress phenomena. Effect of injury on growth or survival. Commercial available databases.

RECOMMENDED READING

James M. Jay, *Modern Food Microbiology* 6th Edition.

Ray, B. 1996. *Fundamental Food Microbiology*

ASSESSMENT METHODS: Written exam

FQC.524 - Food Protein and Enzymes (3 ECTS) _____

LECTURER: Ass. Prof. Efi Tsakalidou

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Provide advanced knowledge in understanding the role of food proteins, as well as the functions of enzymes.

PREREQUISITES: Undergraduate food chemistry.

COURSE CONTENTS

Chemistry and structure of food proteins, enzymic reactions, kinetics, Maillard reactions, enzymic browning.

RECOMMENDED READING

Plasmin in Milk and Dairy Products: an Update (1996), E. C. Bastian and R. J. Brown, *Int. Dairy Journal* 6, p. 435-457.

The influence of ultimate pH and intramuscular fat content on pork tenderness and tenderization (2001), R. L. J. M. van Laack, S. G. Stevens, and K. J. Stalder, *American Society of Animal Science*, 79: 392-397.

Isolation and Identification of Some Major Water-soluble Peptides in Feta Cheese (1998), A. Michaelidou, E. Alichanidis, H. Urlaub, A. Polychroniadou and G. K. Zerfiridis, *J. Dairy Sci* 81: 3109-3116.

The Presence of Oxidizing Enzyme activities in Virgin Olive Oil (1998), M. D. Georgalaki, T. G. Sotiroudis and A. Xenakis, *JAOCS*, Vol. 75, no 2, p. 155-159.

Protein Structure and Function, Stryer L. (1998) *Biochemistry*, W. H. Freeman & Co., NY, p. 15-40, Ch. 2.

Introduction to Enzymes, Stryer L. (1998) *Biochemistry*, W. H. Freeman & Co., NY, p. 177-198, Ch. 8.

Cereal Proteins, Eskin M. N. A. (1990) *Biochemistry of Foods*, Academic Press Inc., NY, p. 176-182, 297-307 and 335-343.

Milk Proteins, Fennema O. R. (1996) *Food Chemistry*, Marcel Dekker Inc., NY, p. 846-849 & 854-863.

Meat Proteins, Fennema O. R. (1996) *Food Chemistry*, Marcel Dekker Inc., NY, p. 884-897 & 913-914.

Enzymatic browning, Eskin M. N. A. (1990) *Biochemistry of Foods*, Academic Press Inc., UK, p. 401-415, Ch. 9.

ASSESSMENT METHODS: Written exam

FQC.525 - Analytical Chemistry II (3 ECTS) _____

LECTURER: Prof. Antonios Calokerinos

TYPE OF COURSE AND TEACHING METHODS: Lectures, Laboratory

OBJECTIVE OF THE COURSE: Provide expertise in analysis focusing on analytical instrumentation.

PREREQUISITES: Undergraduate analytical chemistry.

COURSE CONTENTS

Special advanced topics on analytical chemistry. Introduction to Chemical instrumentation, basic components of analytical instruments, optical detectors (photomultipliers, monochromators, etc.), electrical detectors (pH-electrodes, etc), miscellaneous detectors. Atomic and molecular emission, absorption and fluorescence spectroscopy, Basic principles of analytical instrumentation used in Food Quality, Quality control of food and containers, migration of metals and compounds from container into food. Case studies.

RECOMMENDED READING

- The content of heavy metals in food packaging paper boards: an atomic absorption spectroscopy investigation (1997). Marcelo E. Conti, Food Research International, Vol. 30, No 5, p. 343-348.
- Determination of manganese and chromium in foods by atomic absorption spectrometry after wet digestion (1997). U. Tinggi, C. Reilly and C. Patterson, Food Chemistry, Vol. 60, No 1, p. 123-128.
- The content of heavy metals in food packaging paper: an atomic absorption spectroscopy investigation (1997). M. E. Conti and F. Botre, Food Control, Vol. 8, No 3, p. 131-136.
- The determination of lead in preserved food by spectrophotometry with dibromohydroxyphenylporphyrin (2004). Zaijun Li, Jian Tang, Jiaomai Pan, Food Control 15, p. 565-570.
- Application of the assay of aflatoxins by liquid chromatography with fluorescence detection in food analysis (2000). Journal of Chromatography A, 882, p. 1-10.
- Determination of fluoride in food by the use of alkali fusion and fluoride ion-selective electrode (2001). Marian Kjellefold Malde, Kjell Bjorvatn, Kare Julshamn, Food Chemistry 73, p. 373-379.
- Power Point presentation.

ASSESSMENT METHODS: Written exam

FQC.526 - **Functional Foods and Bioactive Ingredients** (3 ECTS) _____

LECTURER: Dr. Jerzy Zawistowski

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Provide advanced knowledge in the field of nutraceuticals.

PREREQUISITES: Undergraduate food chemistry.

COURSE CONTENTS

Healthy natural foods, fortified foods, nutraceuticals, minerals, vitamins, phytosterols, polyphenols, phytoestrogens, ω -fatty acids, glucosinolates, non-digestible oligosaccharides, prebiotic cultures.

RECOMMENDED READING

- Potential Benefits of Functional Foods and Nutraceuticals to reduce the risk and Costs of Diseases in Canada, B. J. Holub, February 2002, Revised version: May 28/02.
- The flavonoids quercetin and catechin synergistically inhibit platelet function by antagonizing the intracellular production of hydrogen peroxide (2000). P. Pignatelli, F. M. Pulcinelli, A. Celestini, L. Lenti, A. Ghiselli, P. P. Gazzaniga and F. Violi. American Journal for Clinical Nutrition, 72 : 1150-5.
- A new direction in health care: preventive model for health care using functional foods, nutraceuticals desperately needed in Canada, June 18,2003. Guelph Bruce Holub, <http://www.uoguelph.ca/atguelph/>.
- Conjugated linoleic acid supplementation for 1 y reduces body fat mass in healthy overweight humans1-3 (2004). Jean-Michel Gaullier, J. Halse, K. Hoye, K. Kristiansen, H. Fagertum, H. Vik and O. Gudmundsen, American Journal for Clinical Nutrition, 79: 1118-25.
- Functional Foods - A New step in the evolution of food development (2004). Jerzy Zawistowski and David D. Kitts. Clinical Nutrition Rounds, Vol. 4, Issue 4.
- Power Point Presentation.

ASSESSMENT METHODS: Written exam

NPB.522 - **Biochemistry of Secondary Metabolism** (3 ECTS) _____

LECTURER: Dr. Joerg Degenhardt

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: A thorough overview of plant secondary metabolism.

PREREQUISITES: Good knowledge in Organic Chemistry, Biochemistry, Molecular Biology and Plant Physiology.

COURSE CONTENTS

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.

RECOMMENDED READING

Biochemistry & Molecular Biology of Plants, Buchanan, Griseham and Jones, Ch. 24.

Plant Physiology, 2nd Edition, Taiz and Zeiger, Ch. 13.

Power Point Presentation.

ASSESSMENT METHODS: Written exam

NPB.523 - **Chemistry of Terpenoids and Essential Oils** (3 ECTS) _____

LECTURER: Ass. Prof. Vassilios Roussis

TYPE OF COURSE AND TEACHING METHODS: Lectures, Laboratory

OBJECTIVE OF THE COURSE: Provide advanced knowledge in the field of fragrance and flavour through the prism of chemistry and industrial approach.

PREREQUISITES: Organic Chemistry.

COURSE CONTENTS

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.

RECOMMENDED READING

Methods in Plant Biochemistry, 1991, Barry V. Charlwood and Derek V. Banthorpe, Vol. 7, Ch. 1, Ch. 4 and Ch. 5.

ASSESSMENT METHODS: Written exam

NPB.524 - **Chemistry of Alkaloids, Flavonoids and Other Phenolics** (3 ECTS) _____

LECTURER: Ass. Prof. E. Kokkalou

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Provide advanced notions of the chemistry and pharmacology of various natural products.

PREREQUISITES: Undergraduate organic chemistry.

COURSE CONTENTS

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.

RECOMMENDED READING

The Systematic Identification of Flavonoids, 1970, Marby and Thomas Markham, Published by Springer Verlag.

ASSESSMENT METHODS: Written exam

FQC.534 - Laboratory Techniques I (3 ECTS) _____

LECTURER: Dr. Anastasia Detsi

TYPE OF COURSE AND TEACHING METHODS: Lectures, Laboratory

OBJECTIVE OF THE COURSE: To provide knowledge and know how over techniques and methodologies applied in chemical laboratories for food and natural products.

PREREQUISITES: Undergraduate organic chemistry or undergraduate analytical chemistry.

COURSE CONTENTS

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.

RECOMMENDED READING

Basic Gas Chromatography-Mass Spectrometry by F.W. Karasek and R.E. Clement.
Power Point Presentation, notes provided.

ASSESSMENT METHODS: Written exam

FQC.535 - Laboratory Techniques II (3 ECTS) _____

LECTURER: Dr. Dimitrios Makris

TYPE OF COURSE AND TEACHING METHODS: Lectures, Laboratory

OBJECTIVE OF THE COURSE: As continuation of "Laboratory techniques I", the course provides knowledge and know how over techniques and methodologies applied in chemical laboratories for food and natural products.

PREREQUISITES: Undergraduate organic chemistry or undergraduate analytical chemistry.

COURSE CONTENTS

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.

RECOMMENDED READING

Laboratory Techniques, Dimitris Makris, Ph.D. AMRSC, 2005

ASSESSMENT METHODS: Written exam

FQC.541 - New Concepts in Food Packaging (3 ECTS) _____

LECTURER: Dr. George Boskou

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To provide advanced knowledge in packaging technology.

PREREQUISITES: Undergraduate food technology or food chemistry.

COURSE CONTENTS

Introduction–functions of packaging, glass packaging materials, metal packaging materials, electrolytic chromium–coated steel, aluminum, stainless steel, container making processes, paper packaging materials, plastic packaging materials. Interactions between packaging and food, aseptic packaging.

RECOMMENDED READING

Packages that Heat and Cool Themselves(2002). Aaron L. Brody, Food Technology, Products and Technologies Vol. 56, No. 7, p. 80-82.

Antimicrobial food packaging in meat industry (2002). S. Quintavalla, L. Vicini. Meat Science, 62, 373-380.

Food and drink packaging: who is complaining and who should be complaining (2002). B. Winder, K. Ridgway, A. Nelson, J. Baldwin, Applied Ergonomics, 33, 433-438.

ASSESSMENT METHODS: Written exam, Project Presentation

FQC.542 - Trends in Food Processing-Preservation Technologies (3 ECTS) _____

LECTURER: Prof. Constantinos Biliaderis

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Provide advanced knowledge in the field of food processing and preservation.

PREREQUISITES: Undergraduate food technology or food chemistry.

COURSE CONTENTS

Conventional and new developments in food preservation techniques in plant equipment: thermal processing, aseptic processing, microwave heating, low temperature preservation, atmosphere storage, food irradiation, high pressure processing. Quality characteristics and shelf life of foods: examples of degradation mechanisms, viscous and bakery products. Chemical changes during processing and storage of foods. Shelf life prediction. Case studies.

RECOMMENDED READING

Modified Atmosphere Packaging Technology: A Review (1995). Ivor J. Chrch and Anthony L. Parsons, J Sci Food Agric Vol. 67, p. 143-152.

Freezing processes used in the Food Industry (1993). R. M. George, Trends in Food Science & Technology, Vol. 4, p. 134-139.

Food Preservation by hurdle technology (1995). L. Leistner and L. G. M. Gorris, Vol. 6, p. 41-45.

Minimally Processed Fruits and Vegetables: Reducing Microbial Load by Nonthermal Physical Treatments (1997). Dallas G. Hoover, Food Technology, Vol. 51, No 6, p. 66-69.

- Irradiation of Food (1998). Dennis G. Olson, *Food Technology*, Vol. 52, No 1, p. 56-62.
- Non-thermal food preservation: Pulsed electric fields (1997). H. Vega-Mercado, O. Martin-Belloso, Bai-Lin Qin, Fu Jung Chang, M. Marcela Gongora-Nieto, Gustavo V. Barbosa-Canovas and B. G. Swanson, *Trends in Food Science and Technology*, Vol. 8, p. 151-157.
- High-Pressure Processing Begins (1998). Neil H. Hermelstein, *Food Technology*, Vol. 52, No 6, p. 104-106.
- Developments in the active packaging of foods (1999). L. Vermeiren, F. Devlieghere, M. van Beest, N. de Kruijf, J. Debevere, *Trends in Food Science and Technology*, Vol. 10, p. 77-86.

ASSESSMENT METHODS: Written exam

FQC.543 – Food Product Development & Predictive Modeling of Food Quality (3 ECTS)

LECTURER: Prof. Constantinos Biliaderis

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Provide advanced knowledge in the field of food product stability and shelf life assessment in relation to processing-formulation and preservation strategies adopted in food product development.

PREREQUISITES: Undergraduate food technology or food chemistry.

COURSE CONTENTS

Quality aspects & shelf life of foods: (i) Examples of quality degradation mechanisms in foods: liquid foods (fruit juices), semi-liquid and viscous food dispersions, pastry and bakery products; (ii) Chemical changes during processing and storage of foods. Nutritional bioavailability of food constituents. Modelling and prediction of quality loss and microbial growth in foods using kinetics; ASLT methodology, Time-Temperature- Indicators (TTI's) and their use in quality modeling, case studies. Principles in food product development; the R&D process of designing new products, creating prototypes and testing them.

RECOMMENDED READING

- Time-Temperature Indicators. A variety of time-temperature indicators have been developed as a tool to monitor and control distribution and as a meaningful alternative to open dating (1991). Petros S. Taoukis, Bin Fu, and Theodore P. Labuza, *Food Technology*, p. 70-81.
- Predictive Microbiology: Where are we, and where are we going? (1997). D. W. Schaffner and Theodore P. Labuza, *Food Technology*, Vol. 51, No. 4, p. 95-99.
- Functional Foods: Their role in disease prevention and health promotion (1998). *Food Technology*, Vol. 52, No 11, p. 63-70.
- Applications of membrane technology to food processing (1993). F. Petrus Cuperus and Herry H. Nijhuis, *Trends in Food Science and Technology*, Vol. 4, p. 277-282.
- Quantitative evaluation of thermal processes using time-temperature integrators (1996). A. Van Loey, M. Hendrickx, S. De Cordt, T. Haentjens and P. Tobback, *Trends in Food Science and Technology*, Vol. 7, p. 16-25.
- Extraction of secondary metabolites from plant material: A review (1996). Dick A. J. Starmans and Herry H. Nijhuis, *Trends in Food Science and Technology*, Vol. 7, p. 191-197.
- Fundamentals of new food product development (1994). Baker, R.C., Hahn, P.W., Robbins, K.R. Elsevier B.V., Amsterdam, The Netherlands.
- Sensory evaluation of food. Principles and Practises (1998). Lawless, H.T., Heymann, H. Chapman & Hall, New York, NY, USA.
- Functional properties of food components (1991). Pomeranz, Y. Academic Press, Inc., San Diego, CA., USA.
- Food Chemistry (1996). Fennema, O.R. Marcel Dekker, Inc., New York, NY, USA.

ASSESSMENT METHODS: Written exam

FQC.544 - **Food Legislation** (3 ECTS)

LECTURER: Asc. Prof. Maria Tsimidou

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: Provide expertise in the very subtle field of food legislation.

PREREQUISITES: Undergraduate food chemistry of food science in general.

COURSE CONTENTS

Concepts and trends in food legislation. International and federal standards: Codex alimentarius, ISO series, food safety in USA. Legislation in Europe: directives of the official journal of the EU, council regulations, food legislation in UK. Regulating methods for food analysis, case studies.

RECOMMENDED READING

EU Legislation.

FDA Legislation.

Codex Alimentarius documents.

WHO/FAO documents.

OECD documents.

International legislation (Canada, Japan etc).

ASSESSMENT METHODS: Oral Exam, Project Presentation

FQC.545 - **Products of Appellation of Origin** (3 ECTS)

LECTURER: Dr. D. Hornero-Mendez

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To provide expertise in food authenticity.

PREREQUISITES: Undergraduate organic chemistry or food chemistry.

COURSE CONTENTS

Olive oil, wine, honey, Mediterranean edible herbs – infusions, chemical aspects of the identity of products of appellation of origin, (geographical, botanical), chemical fingerprint, laboratory exercises.

RECOMMENDED READING

Color-pigment Correlation in Virgin Olive Oil (1991). M. Isabel Minguez-Mosquera, L. Rejano-Navarro, B. Gandul-Rojas, A. Higinio Sanchez-Gomez and J. Garrido-Fernandez, *JAOCS*, Vol. 68, No 5, p. 332-336.

Carotenoid Biosynthesis changes in five red pepper (*Capsicum annuum* L.) cultivars during ripening. Cultivar selection for breeding (2000). *J. Agric. Food Chem.*, Vol. 48, p. 3857-3864.

Distribution of Chlorophylls and Carotenoids in ripening Olives and between oil and alperujo when processed using a two-phase extraction system (2002). *JAOCS*, Vol. 79, No 1, p. 1-5.

Determination of the geographical origin of Valencia orange juice using carotenoid liquid chromatographic profiles (1999). Pierre P. Mouly, Emile M. Gaydou, Josiane Corsetti, *Journal of Chromatography A*, Vol. 884, p. 149-159.

High-performance liquid chromatography for the characterization of carotenoids in the new sweet orange (Earlygold) grown in Florida, USA (2001). H. S. Lee, W. S. Castle, G. A. Goates, *Journal of Chromatography A*, 913, p. 371-377.

Profiling of colour pigments of chilli powders of different origin by high-performance liquid chromatography (2001). A. Kosa, T. Cserhati, E. Forgacs, H. Morais, T. Mota, A. C. Ramos, *Journal of Chromatography A*, 915, p. 149-154.

Formation and Transformation of Pigments during the Fruit Ripening of *Capsicum annuum* Cv. Bola and Agridulce (1994). M. Isabel Minguez-Mosquera and D. Hornero-Mendez, *Journal of Agricultural and Food Chemistry*, Vol. 42, No 1, p. 38-44.

Separation of picrocrocin, cis-trans-crocins and safranal of saffron using high-performance liquid chromatography with photodiode-array detection (1994). Petros A. Tarantilis, Moschos Polissiou, Michel Manfait, Journal of Chromatography A, 664, p. 55-61.

ASSESSMENT METHODS: Oral Exam, Project Presentation

FQC.546 - Quality Assurance (3 ECTS) _____

LECTURER: Prof. I. Arvanitoyanis

TYPE OF COURSE AND TEACHING METHODS: Lectures

OBJECTIVE OF THE COURSE: To provide competence in the field of quality management covering various systems of quality assurance in the food sector.

PREREQUISITES: Undergraduate food science in general and/or management.

COURSE CONTENTS

Basic concepts and principles of quality management:

The certification process, certification bodies, audit techniques. Quality assurance in laboratories, accreditation regulations & criteria, calibration and verification, calculation of uncertainty, case study.

RECOMMENDED READING

Power Point Presentation, notes provided.

ASSESSMENT METHODS: Written exam, Oral Exam, Project Presentation

ACADEMIC SUPPORT FACILITIES

Laboratory of Chemistry of Natural Products and Analytical Chemistry

It supports academic post-graduate training and research work in the fields of natural product analyses, isolation and identification mainly from vegetal sources as well as in the field of food chemistry. The main axes of activity are: antioxidants and applications, phytochemical analyses, essential oils, olive oil and other edible oils, wine, honey and analytical food chemistry in general, chemical fingerprinting, analyses of residual toxicants in edible substrates.

The facilities include an extended line-up of up-to-date computer assisted instrumentation: Gas Chromatograph equipped with a Flame Ionisation Detector (GC-FID) and a Nitrogen Phosphorous Detector (GC-NPD). Gas Chromatograph equipped with a Flame Ionisation Detector (GC-FID) and an Electron Capture Detector (GC-ECD). Gas Chromatograph equipped with a Flame Ionisation Detector (FID) and a Flame Photometric Detector (FPD). Gas Chromatograph coupled with a Mass Spectrometer (GC-MS (EI, CI)). High Performance Liquid Chromatograph (HPLC) equipped with a Diode Array UV-Vis Detector (DAD) and a Fluorescence Detector (FLD). Two High Performance Liquid Chromatographs (HPLC) equipped with Refractive Index Detectors (HPLC-RI). High Performance Liquid Chromatograph (HPLC) coupled with a Diode Array UV-Vis Detector and a Mass Spectrometer (ESI, APCI). Inductively Coupled Plasma (ICP) Atomic Emission Spectrophotometer. Two Diode Array UV-Visible Spectrophotometers.

In the premises are also available: RANCIMAT, Fluorescence Spectrophotometer, Differential Calorimeter, Lyophiliser, Centrifuges (up to 24.000 rpm), Deep Freeze Chamber.

The following list is an indicative menu of applied techniques.

Pesticide and industrial chemical residues: Electron captive compounds, Systematic Fungicides, Organophosphorous compounds, Triazine Herbicides, Pyrethroides, Determination of Organochlorine Pesticides in oils and fats, Determination of residues of Fenthion in olive oil, Single-step multi cartridge clean-up for Organophosphate pesticide residues. Determination in Vegetable Oil Extracts.

Water. Trihalomethanes in water, Volatile halogenated organics, Organohalide pesticides, Nitrogen and phosphorous containing pesticides.

Flavours-Essential oils. Extraction of volatile compounds from plant material, Analyses of essential oil aromatic compounds.

Fruits and Fruit Products. Organic acids in fruit juices, Carbohydrates in fruit juices, Anthocyanins in fruit juices, Ethylene in fruits, Flavour analysis.

Oils and Fats. Moisture and volatile matter, Determination of oil content in oleaginous seeds, Iodine value, Peroxide value of oils and fats, Acidity, Evidence of purity and deterioration from UV, Fatty acid methyl esters, Determination of the unsaponifiable matter, Qualitative and Quantitative determination of sterols, Determination of polar compounds in frying fats, Determination of purgeable halocarbons in olive oil, Determination of fatty acids in the 2-position in the Triglycerides, Determination of Triglycerides, Determination of Tocopherols, Determination of stigmastadienes in vegetable oils.

Antioxidants. Evaluation of antioxidant activity in foods, plant extracts and the agro industrial waste. Development of new methods for antioxidant activity tests. Isolation of natural antioxidants, elaboration of methods for eventual use in scale-up experiments.

Chemical Fingerprinting. Study of the chemical profiles of several products or plants (phenolics, sugars, volatiles, etc) and association with origin and identity. Adulteration control. Use of marker molecules to track down provenance.

MASTERS OF SCIENCE PROGRAM

Research Project (9 month duration)

Requirement

60 ECTS credits. Laboratory techniques (Related to the subject of the Master Thesis)

Research Subject Areas (topics generally available for Master of Science thesis):

- Isolation, structural elucidation of various natural products.
- Antioxidants: isolation and screening for antioxidant activity.
- Added value products from cheap, renewable sources.
- Methodologies for the estimation of antioxidant activity and/or free radicals, peroxides.
- Model systems to study mechanisms of antioxidant activity.
- Toxicant residues in food.
- Chemical fingerprinting of food and drink products: authenticity, origin.
- Antifraud chemical methodologies.

Indicative master thesis realized within the area

TITLE: Model oxidation of quercetin: Isolation of two major oxidation products and evaluation of their antioxidant properties (2006)

AUTHOR: Aytac Gulsen, Food Engineer, Turkey

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

THESIS DIRECTORS: Dimitrios Makris

TITLE: Testing algorithms using fatty acid methyl esters and triglyceride analyses to determine the authenticity of various vegetable oil blends (2005)

AUTHOR: Ariela Ferra, Food Chemist, Albania

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

THESIS DIRECTORS: Maria Tsimidou

TITLE: Quality assessment of frying oils and HACCP safety guidelines for fried foods (2005)

AUTHOR: Mihalea-Elena Ghidurus, Industrial Biotechnology, Romania

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

THESIS DIRECTOR: George Boskou

TITLE: New formulations for the production of Pasta (Lasagna) enriched with Legume protein (2004)

AUTHOR: Dimitrios Sabanis, Chemist, Greece

PLACE OF REALIZATION: Laboratory of Food Chemistry & Technology, Aristotle University of Thessaloniki, Thessaloniki, Greece

THESIS DIRECTORS: Georgios Doxastakis

TITLE: Phenolic profile and antioxidant activity of the date palm (*Phoenix dactylifera*) ripe fruit (2004)

AUTHOR: Abdelhak Mansouri, State Engineer in Agronomy, Algeria

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

THESIS DIRECTOR: Eugenios Kokkalou

TITLE: Consumer Behaviour Analysis: The Romanian Olive oil and Honey Markets (2003)
AUTHOR: Loredana Biro, Engineer, Romania
PLACE OF REALIZATION: Department of Natural Products & Biotechnology, Mediterranean Agronomic Institute of Chania, Chania, Greece
THESIS DIRECTOR: Ioannis Arvanitoyannis

TITLE: Application of the HACCP System to Tahini (Sesame Cream) production at the Kanater factory in the Lebanon (2003)
AUTHOR: Fahed Ayoub, Agronomic Engineer, Lebanon
PLACE OF REALIZATION: Fanar Laboratory, Agricultural Research Institute, Fanar, Lebanon
THESIS DIRECTOR: Christo Hilan

TITLE: Pilot extraction of carotenoids from orange peel of the Valencia variety (2003)
AUTHOR: Ghada Bandak, Chemist, Palestine
PLACES OF REALIZATION: Department of Food Quality Management & Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Chania, Greece
THESIS DIRECTORS: Damaso Hornero-Mendez

TITLE: Application of peroxyoxalate chemiluminescence for the quantification of hydroxyperoxides and screening of antioxidant activity in non-aqueous media (2003)
AUTHOR: Van Stepanyan, Food Technician, Armenia
PLACE OF REALIZATION: Department of Food Quality Management & Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Chania, Greece
THESIS DIRECTOR: Panagiotis Kefalas

TITLE: Sensory and trace element analysis for the classification of honey of various geographical and botanical origins (2003)
AUTHOR: Cherif Chalhoub, Chemist, Lebanon
PLACE OF REALIZATION: Department of Food Quality Management & Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Chania, Greece
THESIS DIRECTORS: Nikolaos Lydaki-Symantiris, Ioannis Arvanitoyannis

TITLE: Assessment of the antioxidant activity of virgin olive oil by DPPH free radical and Co(II)/EDTA-Induced luminol chemiluminescence methods (2003)
AUTHOR: Sinan Caner Bayramoglu, Food Engineer, Turkey
PLACE OF REALIZATION: Department of Food Quality Management & Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Chania, Greece
THESIS DIRECTOR: Panagiotis Kefalas

TITLE: Determination of major anthocyanin pigments in Hellenic native grape varieties (*Vitis vinifera* sp.): Association with antiradical efficiency (2003)
AUTHOR: Adel Abdel-Razek Abdel-Azeem Mohdaly, Food Industries, Egypt
PLACE OF REALIZATION: Department of Food Quality Management & Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Chania, Greece
THESIS DIRECTOR: Stamatina Kallithraka, Panagiotis Kefalas

TITLE: Tea and herbal infusions: their antioxidant activity and phenolic profile (2003)
AUTHOR: Ali Khalil Atoui, Agro-Nutritional Technology, Lebanon
PLACE OF REALIZATION: Department of Food Quality Management & Chemistry of Natural Products, Mediterranean Agronomic Institute of Chania, Chania, Greece
THESIS DIRECTOR: George Boskou

References of the main academic staff teaching within the M.Sc.

More than 20 invited lecturers from about 5 countries participate in each edition of the M.Sc. programme of which, 26% came from Research Institutes, 62% from Higher Education Institutions, 12% from Private Companies. Considering their implication in the programme, the following academic staff is taken as reference:

CANADA

Private companies

- Jerzy Zawistowski, Functional Foods and Nutraceuticals. Forbes Medi-Tech Inc, Vancouver

GERMANY

Research Institutes

- Joerg Degenhardt, Max Planck Institute for Chemical Ecology, Jena

GREECE

Higher Education Institutions

- Athanasios Papadopoulos, University of Crete, Rethymnon
- Antonios Calokerinos, University of Athens, Athens
- Dimitrios Boskou, Aristotle University of Thessaloniki, Thessaloniki
- Konstantinos Biliaderis, Aristotle University of Thessaloniki, Thessaloniki
- Effie Tsakalidou, Agricultural University of Athens, Athens
- Thomas Bintsis, Aristotle University of Thessaloniki, Thessaloniki
- Vassilios Roussis, University of Athens, Athens
- Evgenios Kokkalou, Aristotle University of Thessaloniki, Thessaloniki
- George Boskou, Charokopio University, Athens
- Maria Tsimidou, Aristotle University of Thessaloniki, Thessaloniki
- Ioannis Arvanitoyannis, University of Thessaly, Volos

Research Institutes

- Anastasia Detsi, Technical University of Athens, Athens
- Dimitrios Makris, National Agriculture Research Foundation, Athens

LEBANON

Higher Education Institutions

- Zeina Kassaify, American University of Beirut, Beirut

SPAIN

Research Institutes

- Damaso Hornero-Mendez, Instituto de la Grasa, CSIC, Sevilla

The Institute reserves the right to replace its visiting faculty according to its evaluation process.