

COURSE: Microbiology of Mediterranean Fermented Foods

ACADEMIC YEAR: 2017-2018

TYPE OF EDUCATIONAL ACTIVITY: (Basic, Characteristic, Affine, Free choice, Other) Curricular

LECTURER: Prof. Eugenio Parente

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mobile (optional):

Language: English

ECTS: 9 (8 Lectures + 1 practicals)	n. of hours: 64 h lectures + 16 h practicals	Campus: Potenza Dept./School: School of Agriculture, Forest, Food and Environmental Sciences Program: LM 70 EDAMUS	Semester: 1
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#### EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

This is an advanced course in Microbiology of fermented foods produced in Mediterranean countries. Given the likely background of the EDAMUS students, its objective is to provide a background on food microbial ecology, to provide food technologists with the knowledge and skills needed for the management of the microbiological quality and safety of fermented foods and the ability to apply these skills to existing traditional processes or in the development of new foods/food processes.

- **knowledge and understanding:** Knowledge and understanding of the principles and methods of food microbial ecology. Knowledge and understanding of the factors affecting microbial growth and survival in fermented foods. Knowledge and understanding of the microbial groups involved in the safety, spoilage and fermentation of fermented foods. Basic knowledge and understanding of the technology of starter cultures. Knowledge and understanding of the principles and methods for the formulation and implementation of Hazard Analysis Critical Control Points plans.
- **applying knowledge and understanding:** Ability to identify the factors that control microbial contamination, growth and survival in a specific food product and to identify the means for the control of the most relevant spoilage and pathogenic microorganisms. Ability to identify the beneficial microorganisms which are relevant for the sensory properties and the quality of fermented foods. Ability to select starter cultures for a specific fermentation process. Ability to develop Hazard Analysis Critical Control plans and use them in microbiological quality assurance of fresh and minimally processed foods.
- **making judgements:** Ability to identify the most effective tools for microbial quality assurance in the development of new products and processes and in the improvement of existing ones.
- **communication skills:** Ability to communicate the impact of microorganisms on food quality and safety to both non-technical and technical audiences. Risk communication skills. Ability to interact and communicate with food business operators in the development and implementation of microbial quality assurance tools and solutions. Ability to communicate with representative of food safety agencies, official control agencies and quality certification agencies in all the steps needed for the registration and approval of a food production/distribution plant and during food quality and safety audits.
- **learning skills:** Ability to access sources of statistical data relevant to quality assurance (epidemiological databases, surveillance databases, Rapid Alert System for Foods and Feeds), to understand and summarize the data. Ability to access documentation and information sources on fermented food microbial quality and safety using technical and scientific literature.

#### PRE-REQUIREMENTS

To understand the material presented in this course the following knowledge and skills are needed (note that these are usually provided in BSc courses in Food Science and Technology):

- general microbiology (≥6 ECTS credits: structure and physiology of microorganisms, microbial growth, genetics, microbial taxonomy),
- food unit operations and food technology (≥12 ECTS credits): knowledge and understanding of the most important unit operations which affect contamination, growth and survival of microorganisms (thermal treatments, drying, refrigeration, freezing, etc.) and of the processes and technologies used in the

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- production of the main categories of fresh and minimally processed foods
  - basic knowledge in mathematics and statistics: knowledge and understanding of analysis and calculus, basic concepts in statistics (characterization of samples and populations, hypothesis testing, experimental design, regression methods)
  - English language skills ( $\geq$  B1) and basic skills in information technology
  - basic concepts in general and organic chemistry, biochemistry and food chemistry
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#### SYLLABUS

The group is divided in 6 teaching blocks. After an introduction to methods and concepts in food microbiology, the microbial groups which are relevant for the safety and quality of fermented foods will be described and the metabolism of beneficial microbes relevant to fermented food quality will be briefly outlined. Current approaches to the technology of starter cultures will be briefly described. Examples of typical production processes for Mediterranean fermented foods will be presented both in lectures and during visits to food plants. The basics of risk analysis and HACCP will be illustrated.

#### **Block 1.** The theoretical basis of food microbiology (12 h, lectures)

Recall of notions on the role of microorganisms in food spoilage and safety. The theoretical bases and methods in food microbial ecology. Factors affecting the growth and survival of microorganisms in foods.

#### **Block 2.** An introduction to food safety. (8 h, lectures).

Epidemiology of food borne diseases. Risk analysis. The main pathogenic microorganisms in foods: risk identification and characterization, exposure assessment, outline of approaches for risk management.

#### **Block 3.** Microbial groups and their role in the quality and safety of fermented foods (with emphasis on beneficial microbes) (12 h lectures, 8 h laboratory).

Ecology, taxonomy and physiology of lactic acid bacteria, staphylococci, spore forming bacteria, coryneforms, yeasts and moulds. Basic laboratory techniques for the enumeration, identification and characterization of microorganisms.

#### **Block 4.** Metabolism of beneficial microbes in fermented foods, technology of starter cultures (12 h, lectures)

Metabolism of carbohydrates, organic acids, proteins and lipids in foods. An introduction to the technology of starter cultures. Bacteriophages in foods.

#### **Block 5.** The microbiology of selected fermented foods (12 h lectures, 8 h laboratory)

Traditional fermented product vs. commodity foods. Traditional fermented foods in the Mediterranean: identity, quality schemes. Microbiology of traditional cheeses: pasta filata cheeses, ewe's milk cheeses, semi-hard and hard cheese varieties. Microbiology of traditional fermented sausages and other fermented meat products. Visits to SME producing fermented foods.

#### **Block 6.** Development and implementation of HACCP plans (8 h, lectures)

Qualitative and quantitative risk analysis. Recalls of the principles of HACCP systems. An introduction to the design of HACCP plans.

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#### TEACHING METHODS

The course includes 64 h lectures and 16 h practical (laboratory, visits to food plants). The students attending the course will be stimulated to actively participate to the course using a variety of methods (writing of short essays and articles on food fermentation, safety and risk analysis/communication, extraction and processing of data from epidemiological and surveillance databases)

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#### EVALUATION METHODS

The students attending the course need to pass one mid term written examination (multiple choice, true/false, short text, short essay) and a final oral examination. A variety of exercises, carried out by students working in groups, will be used to assess the ability to applying knowledge and understanding, making judgements and communication skills (short journal articles, blog posts, short presentations, predictive microbiology exercises).

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#### TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

Course material and handouts will be provided in electronic format during the course and temporarily stored on a document cloud which will be made accessible to the student.

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The students are also encouraged to widen their knowledge using textbooks available in the library:

- B. Ray 2003 Fundamental Food Microbiology. CRC Press
- ICMFS 2010 Microorganisms in foods 6. Microbial ecology of food commodities. Kluwer Academic.

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#### INTERACTION WITH STUDENTS

During the first lecture, the student's knowledge, skills and pre-requisites will be evaluated with a short written examination, and the structure and organization of the course and the evaluation procedure will be presented. The teaching material (slide print-outs, exercises, further hand outs) will be made available to students using a cloud storage system (Dropbox or Google Drive) or made available on a pen drive. The outcome of written examinations will be made available by E-mail.

The lecturer will be available for receiving students at least 4 h a week (on Tuesdays and Wednesdays). The students can also communicate with the lecturer via E-mail.

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#### EXAMINATION SESSIONS (TENTATIVE)<sup>1</sup> 8/11/2017

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#### EVALUATION COMMITTEE

Prof. Eugenio Parente (president), Prof. Annamaria Ricciardi (member), Prof. Patrizia Romano (replacement member), Prof. Angela Capece (replacement member)

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SEMINARS BY EXTERNAL EXPERTS    YES     NO

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#### FURTHER INFORMATION

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<sup>1</sup> Subject to possible changes: check the web site of the Teacher or the Department/School for updates.