

COURSE: Food Safety and Preservation

ACADEMIC YEAR: 2018-2019

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

LECTURER: Prof. Eugenio Parente

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mobile (optional):

Language: Italian

ECTS: 9 (8 Lectures + 1 practicals)	n. of hours: 72 h lectures + 16 h practicals	Campus: Potenza Dept./School: School of Agriculture, Forest, Food and Environmental Sciences Program: MSc in Food Science and Technology	Semester: 1
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EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

This is an advanced course in Food Microbiology. Its objective is to provide food technologists the knowledge and skills needed for the management of the microbiological quality and safety of foods and the ability to apply these skills to existing 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 microbial groups which are involved in the safety and spoilage of raw, fresh, minimally processed and shelf-stable foods and beverages (meat and poultry, eggs, seafood and fish, dairy, produce, fruits, water) and of the methods for the control of contamination, growth and survival of microorganisms. Knowledge and understanding of the methods and experimental approaches of predictive microbiology and risk analysis. 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 develop Hazard Analysis Critical Control plans and use them in microbiological quality assurance of fresh and minimally processed foods. Ability to use databases and software for predictive microbiology applications.
- **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 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 microbiology and hygiene (≥ 9 ECTS credits: basic food microbial ecology; effect of intrinsic, extrinsic and implicit factors on the growth and survival of microorganisms in foods, microorganisms involved in food poisoning, national and international regulations on food hygiene, basic knowledge of methods for the microbiological analysis of foods)

- 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 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

SYLLABUS

The course is divided in 9 teaching blocks. For each of the blocks describing specific food categories the initial microbiota, the impact of processes and preservation on spoilage, the most relevant food pathogens, and the technologies for the control of microorganisms relevant for food safety and quality will be described.

Block 1. The theoretical basis of food microbiology (4 h, lectures)

Recall of notions on the role of microorganisms in food spoilage and safety. The theoretical bases and methods in food microbial ecology.

Block 2. Modelling growth and survival of microorganisms in foods. (8 h, lectures).

Primary models for growth (empirical models, mechanistic models). Primary models for inactivation (first order model, Weibull's model, more models). A primer on models for survival and contamination. Secondary models (polynomial models, semi-empirical models, gamma and cardinal model, probabilistic models).

Block 3. Software and databases for predictive microbiology (16 h, practicals, computer room)

Databases for predictive microbiology: Combase browser, Microbial Response Viewer. Software for primary models: Dmfit, GlnaFIT. Model interfaces: Combase predictor, Pathogen modelling program. Qualitative and quantitative risk analysis tools: RiskRanger, MicroHibro.

Block 4. Safety and preservation of meat and poultry products. (10 h, lectures)

Control of microorganisms in fresh, minimally processed and shelf-stable meat and poultry products (fresh and frozen meat, cured meat products, RTE meat products, heat processed products)

Block 5. Safety and preservation of milk, creams and egg products (8 h, lectures)

Control of spoilage and pathogenic microorganisms in raw, pasteurized and UHT milk and creams, butter. Shell eggs, liquid and dried egg products.

Block 6. Safety and preservation of fish and seafood (6 h, lectures)

Control of spoilage and pathogenic microorganisms in fish, molluscs and crustaceans (fresh, frozen, minimally processed and shelf-stable products)

Block 7. Microbiological quality of water. Safety and preservation of produce and fruit products (8 h, lectures)

The microbiology of drinking water and mineral water. Control of spoilage and pathogenic microorganisms in fresh and minimally processed fruits and produce, vegetable and fruit juices, shelf-stable products.

Block 8. Cereals and cereal products. RTE and multi-ingredient foods. (8 h, lectures)

Control of microorganisms in cereals and flours, pasta and pastries, RTE foods and multi-ingredient perishable foods.

Block 9. Risk analysis, development and implementation of HACCP plans (14 h, lectures)

Qualitative and quantitative risk analysis. Recalls of the principles of HACCP systems. Presentation and discussion of case studies for the development of HACCP and quality assurance programs for the control of microorganisms relevant to spoilage and safety.

TEACHING METHODS

The course includes 64 h lectures and 16 h practical (computer room). 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 safety and risk analysis/communication, extraction and processing of data from epidemiological and surveillance databases, use of predictive microbiology software for the evaluation of the growth and survival of microorganisms in foods)



EVALUATION METHODS

The students attending the course need to pass two written (mid term, end of course) examinations (multiple choice, true/false, short text, short essay), in addition to 10 min mini-tests (T/F and multiple choice questions) delivered biweekly. Mini-tests and written examinations contribute to up to 75% of the final evaluation and are designed to evaluate knowledge and understanding rather than abilities/capabilities. 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). To obtain top grades (>27) the students, working in groups, will have to develop and discuss a HACCP plan on a food indicated by the lecturer (this activity is interdisciplinary and is carried out jointly with "Analysis, quality and development of food product" course).

The students not attending the course or who are unable to pass the written examinations will have to sit for an oral examination and a practical examination (predictive microbiology exercise, an exercise on the development of HACCP plan)

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.

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

- James M. Jay, Martin J. Loessner, and David A. Golden 2009 Microbiologia degli alimenti, Springer-Verlag Italia
- G. A. Farris, M. Gobetti, E. Neviani, M. Vincenzini (a cura di) 2012 Microbiologia dei prodotti alimentari. Casa Editrice Ambrosiana
- Gardini F., Parente E. (a cura di) 2013 Manuale di microbiologia predittiva. Springer Verlag Italia
- B. Ray 2003 Fundamental Food Microbiology. CRC Press
- ICMFS 2010 Microorganisms in foods 6. Microbial ecology of food commodities. Kluwer Academic.

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.

EXAMINATION SESSIONS (TENTATIVE)¹

13/2/2019, 14/3/2019, 17/4/2019, 15/5/2019, 12/6/2019, 24/7/2019, 18/9/2019, 16/10/2019, 13/11/2019, 11/12/2019, 15/1/2020.

EVALUATION COMMITTEE

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

SEMINARS BY EXTERNAL EXPERTS YES X NO

FURTHER INFORMATION

Limited to AA 2018-2019 Dott. G. Salvatore, Official Control of Foodstuffs, Regione Basilicata, will deliver 8 h lectures/seminars on official control and HACCP plans.

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