SCUOLA DI SCIENZE AGRARIE, FORESTALI, ALIMENTARI ED AMBIENTALI

COURSE: Food Microbiology	
ACADEMIC YEAR: 2018-2019	
TYPE OF EDUCATIONAL ACTIVITY: (Basic, Characteristic, Affine, Free choice, Other) Curricular	
LECTURER: Prof. Eugenio Parente	
e-mail: eugenio.parente@unibas.it	web: http://www2.unibas.it/parente/wordpress/
phone: 0971/205561	mobile (optional):
Language: Italian	

ECTS: 12 (10 Lectures + 2 practicals)	n. of hours: 112 (80 h lectures + 32 h practicals)	Campus: Potenza Dept./School: School of Agriculture, Forest, Food and Environmental Sciences Program: BSc in Food Technology	Semester: 1-2

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

This is an introductory 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.

- **knowledge and understanding:** Basic knowledge of the principles and methods of food microbial ecology. Knowledge of the effect of the main intrinsic, extrinsic and implicit factors on growth and survival of pathogenic, spoilage and beneficial microorganisms. Knowledge of the principles for the control of microorganisms using physical, chemica and biological treatments. Knowledge of the principles of risk analysis and risk control. Knowledge of the principles for fixing microbiological criteria for foods. Knowledge of the methods for detecting or counting microorganisms used as safety or process criteria. Basic knowledge of the approaches for risk assessment for the main food pathogenic microorganisms. Basic knowledge of the principles of the HACCP system. Basic knowledge of the microbiology of the main food commodities.
- **applying knowledge and understanding**: Capability to evaluate which factors contronl contamination, growth and survival of microorganisms and to select simple approaches for the control of microorganisms. Capability to carry out microbiological analysis of foods and to interpret the results of the tests. Capability to manage HACCP plans and microbiological quality assurance systems for basic food commodities. Capability to use simple database and model interfaces for predicting growth and survival of microorganisms in foods.
- **making judgements**: Capability to select, among a range of choices, the methods or techniques for microbiological assurance of foods and for the management of existing processes.
- **communication skills**: Ability to communicate the impact of microorganisms on the quality and safety of foods to technical and non-technical audiences. Capability to interact with official control personnel during audits and during registration and certification of food plants. Ability to discuss with managers and techicians the technical alternatives for quality assurance of foods.
- **learning skills**: Ability to gather information on microbiological quality of foods using statistical and epidemiological data bases, technical literature nd, to a lesser extent, 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 (≥6 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 (≥ B1) and basic skills in information technology
- basic concepts in general and organic chemistry, biochemistry and food chemistry

SYLLABUS

The course is divided in 12 teaching blocks (1 ECTS credit each).

Block 1. Introduction to food microbial ecology (8 h, lectures)

Microorganisms and food quality: impact of microorganisms on safety, sensory and nutritional quality of foods (2 h). Methods in food microbial ecology (1 h). Introduction to predictive microbiology (2 h). Stress response (1 h). Death kinetics (1 h). Intrinsic, extrinsic and implicit factors (1 h).

Block 2. The control of microorganisms - 1. (8 h, lectures)

Control of microorganisms: hygiene, cleaning and sanitation (2 h). Control of pH and use of organic acids (1 h). Control of a_W, drying and dehydration (1 h). Use of refrigeration and freezing (2 h). High temperatures (2 h).

Block 3. The control of microorganisms - 2. (8 h, lectures)

Other physical methods: ionizing radiations, high hydrostatic pressure, pulsed electric fields, pulsed light, cold plasma (2 h). Packaging and protective atmospheres (1 h). Food additives: chemical preservatives, antibiotics, natural preservatives (2 h). Implicit factors: competition, amensalism, commensalism, mutualism (1 h). Introduction to food fermentations (2 h).

Block 4. Risk assessment and management - 1. (8 h, lectures)

Epidemiology of foodborne diseases and surveillance systems (1 h). Biological risk in foods (2 h). Food hygiene (1 h). Introduction to Italian and European legislation on food hygiene (2 h). Qualitative and quantitative risk analysis: risk assessment, risk management, risk communication (2 h).

Block 5. Risk assessment and management - 2. (8 h, lectures)

Microbiological criteria (2 h). Methods for process criteria and food safety criteria (2 h). Foodborne diseases. 1: *Salmonella*, *Campylobacter*, enteropathogenic *Escherichia coli* (4 h)

Block 6. Predictive microbiology tools. Methods for enumeration of microorganisms in foods (16 h, computer room, laboratory)

Introduction to the use of databases and model interfaces for predictive microbiology (8 h). Guided exercises for the search of information on prevalence of foodborne diseases, contamination levels, ability to grow or survive (4 h). Introduction to microbiological methods for the enumeration of food microbes (4 h).

Block 7. Risk assessment and management - 3. (8 h, lectures)

Foodborne diseases 2: *Staphylococcus aureus*, *Listeria monocytogenes*, *Clostridium perfringens*, *Clostridium botulinum, Bacillus cereus* (4 h). *Vibrio cholerae* e *V. parahaemolyticus*. Other pathogenic bacteria. protozoa, parasites, algal toxins and micotoxins (2 h). Introduction to the principles of Hazard Analysis Critical Control Points (2 h)

Block 8. Risk assessment and management - 4. (8 h, lectures)

Planning and implementation of HACCP plans: case studies. Hazard analysis, identification of CCP, criteria, management of non-conformities, verification, documentation. (8 h)

Block 9. Microbiology of selected food commodities - 1. (8 h, lectures)

Dairy microbiology: raw, pasteurized and UHT milk. Starter technology. Dairy fermented products: yoghurt, cheese.

Block 10. Microbiology of selected food commodities - 2. (8 h, lectures)

Meat microbiology: red meats, poultry meats, chilled, minimally preserved products, shelf-stable products. Fermented meat products. Introduction to the microbiology of eggs and egg products.

Block 11. Microbiology of selected food commodities - 3. (8 h, lectures)

Microbiology of fish and seeafoods. Microbiology of vegetable products and cereals. Introduction fo fermented beverages and fermented baked goods.

Block 12. Microbiological analysis of selected food commodities (16 h, laboratory)

Microbiological analysis of dairy, meat and vegetable products.

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TEACHING METHODS

The course includes 80 h lectures and 32 h laboratory or computer room activities. Active learning will be promoted by a variety of exercises (data extraction, prediction of growth and survival, risk communication). **Please note**: laboratory activities only will be possible if personnel and economic resources are made available. If resources are insufficient active participation of students will be impossible and demonstrations will replace practical activities.

EVALUATION METHODS

For students attending the course there will be 4 mid term exams (multiple choice questions, list, short essays; two mid term during the first semester, two mid term in the second semester; 70% of total score). Home work to be carried out in groups of max 4 students (15% of total score) will test the ability to communicate of food hygiene and the role of microorganisms in foods and the ability to use simple predictive microbiology tools. A final oral examination is needed to obtain full grades (15% of total score).
Students not attending the course or whom are unable to pass the mid terms will sit for an oral exam.

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 students.

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

- G. A. Farris, M. Gobbetti, E. Neviani, M. Vincenzini (a cura di) 2012 Microbiologia dei prodotti alimentari. Casa Editrice Ambrosiana
- James M. Jay, Martin J. Loessner, and David A. Golden 2009 Microbiologia degli alimenti, Springer-Verlag Italia
- Gardini F., Parente E. (a cura di) 2013 Manuale di microbiologia predittiva. Springer Verlag Italia

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 handouts) 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]

16/10/2019, 13/11/2019, 11/12/2019, 15/1/2020, 12/2/2020, 11/3/2020, 15/4/2020, 13/5/2020, 10/6/2020, 15/7/2020, 10/9/2020, 14/10/2020, 11/11/2020, 16/12/2020, 13/1/2021, 10/2/2021

EVALUATION COMMITTEE

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

SEMINARS BY EXTERNAL EXPERTS YES X NO □

FURTHER INFORMATION

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