

COURSE: Food microbiology

ACADEMIC YEAR: **2018-2019**

TYPE OF EDUCATIONAL ACTIVITY: Characteristic

TEACHER: Patrizia Romano

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mobile (optional):

Language: Italian

ECTS: 12 (10 lectures; 2 laboratory practice)	n. 112 of hours: 80 lectures 32 laboratory practice	Campus: Potenza School: School of Agriculture, Forest, Food and Environmental Sciences (SAFE) Program: Food Technology	Semester: I and II
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#### EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

This is a basic course in Food Microbiology; its objective is to provide students of 1st level in Food Technology the knowledge on the control of spoilage, pathogens and toxigenic microorganisms in foods and knowledge of the role of microorganisms in the processing and production of fermented foods.

- **Knowledge and understanding:** Knowledge of pro-technological, probiotic, pathogens and spoilage microorganisms associated with foods, their origin and role. Knowledge of the microbial groups which are involved in food-borne diseases. Knowledge of the factors that determine the presence, growth and survival of microorganisms in food. Knowledge of the main microbial groups involved in the production of fermented foods. Knowledge of the significance of starter culture. Knowledge needed to microbiological control in food.
- **Applying knowledge and understanding:** Ability to identify the risk factors for microbiological food safety. Ability related to the microbiological control in foods through appropriate and targeted applications of physical, chemical and biological treatments; ability to apply basic microbiological methods for the evaluation of the microbial load in the different food matrices; ability of monitoring the microbial growth in fermented foods; ability to apply the selection scheme for starter cultures.
- **Making judgements:** Ability to identify and apply the most effective treatments for the control of spoilage, pathogen, toxigenic microorganisms on foods. Ability to identify the most effective tools to assure microbiological safety of foods, on the basis of production process. Ability to select microorganisms suitable for the production of fermented foods. Ability to apply the microbiological food control.
- **Communication skills:** Ability to communicate to technical and non-technical the positive and negative basic role of microorganisms in foods and the potential treatments for their control and safety. Ability to interact with entrepreneurs and technicians of food companies in the planning and production of fermented foods.
- **Learning skill:** Ability to access the sources of referenced data on microbiological control of fermented and non-fermented foods and summarize data. Ability to gather information on basic topics concerning microbial control in fermented and non-fermented foods using the scientific and technical literature.

#### PRE-REQUIREMENTS

For a successful course attendance by students, basic and general microbiology knowledge is required (at least 6 ECTS credits: structure and physiology of microorganisms, microbial growth, genetics, microbial taxonomy)

#### SYLLABUS

The course is divided into 9 blocks, of which 8 lectures on specific topics focused on chemical and physical factors that affect microbial growth in foods, the composition and the role of microorganisms in different fermented and non-fermented foods and microbiological control. A block is devoted to laboratory activity on microbiological analysis and control in some foods.

**Block 1.** Colonization, contamination and microbial metabolism. Knowledge of physicochemical factors influencing the presence and evolution of microorganisms in food. Primary and secondary microbial contamination sources (8 h, lectures).

**Block 2.** Microbial ecology of the main foods. Pro-technological, probiotics, pathogen and spoilage microorganisms

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associated with foods and their origin and role. Methods for the measurement of the kinetics of microbial growth in foods (8 h, lectures).

**Block 3.** Classification of food-borne diseases and bacterial agents involved. Characteristics of bacterial groups responsible for infections, intoxications and toxoinfections: *Salmonella*, *Campylobacter*, enteropathogenic *Escherichia coli*, *Staphylococcus aureus*, *Listeria monocytogenes*, *Clostridium perfringens*, *Clostridium botulinum*, *Bacillus cereus*, *Vibrio cholerae* e *V. parahaemolyticus*. Other pathogenic microorganisms. Algae toxins and mycotoxins. For each microorganism, it will be analyzed: eco-physiological characteristics, virulence factors, symptoms, sources and contamination pathways, food involved, control procedures, methods for determination and monitoring. (16 h lectures).

**Block 4.** Microbial control in foods using physical, chemical and biological treatments or combinations thereof. Control of microorganisms in food by acidification, water activity ( $a_w$ ) lowering, low or high temperatures, freezing. Control of microorganisms in foods by treatment with microwaves, ionizing radiation (8 h, lectures).

**Block 5.** Microbial control in foods through treatment with high pressure pulsed electric currents. Microbial control in food by chemical treatments. Preservatives and antimicrobial activity. Effect of treatments on different microbial groups through modification of the food atmosphere (8 h, lectures).

**Block 6.** Microorganisms associated with foods (bacteria, yeasts, molds). The role of microorganisms on the human health. Probiotic microorganisms. Microorganisms as indicators of quality and of food microbiological safety. Microorganisms of unfermented foods (8 h, lectures).

**Block 7.** The fermentation. Main microbial groups involved in the production of fermented foods. Role of microorganisms as starter in the production of fermented foods and knowledge of their metabolism to the enhancement of the organoleptic and healthy quality of the products. Dairy microbiology: microorganisms of interest: lactic acid bacteria, yeasts, molds (8 h, lectures).

**Block 8.** Microbiology of fermented beverages: microorganisms of interest: lactic acid bacteria, yeasts, molds. Alcoholic fermentation, malo-alcoholic and malolactic fermentations. Specific substrates for the isolation of the various microbial groups. Yeast starter and selective parameters: fermentative performance, antimicrobial resistance, killer character, production of secondary compounds (8 h, lectures).

**Block 9.** Microbiology of meat products. Evolution of different microorganisms during manufacture of salami. Lactic acid bacteria and positive characters. Microbiology of vegetable products. Microbiology of cereals and derived (bread): microbial species and role. Production of beer, yeast starter and formulation (8 h, lectures).

**Block 10.** Food microbiological analysis. Determination of the number and/or the presence of specific microbial populations. Interpretation of analytical results: microbiological criteria and standards. In vitro test for the determination of the inhibition of the total microbial load as a function of chemical and physical changes in the culture media. Isolation techniques and technological characterization of microorganisms to be used as starter cultures (32 h, laboratory practice).

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#### TEACHING METHODS

The course consists of 80 hours of theoretical lectures on all topics of the course and 32 hours of laboratory practices. During the practices, students will be divided for laboratory work and will be directed to apply all the steps for the microbiological control of a food and for the monitoring of an inoculated fermentation. The students attending the course will be stimulated to participate actively to the course with exercises related to laboratory activities and the preparation of a short report on the analysis of the results of the experiments carried out in laboratory.

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#### EVALUATION METHODS

The students attending the course need to pass three examinations (mid term, end of course) that have the aim to assess the level of achievement of the previously mentioned educational goals.

The exam is divided into 3 parts:

- An oral or written intermediate assay (mainly quiz at multiple answers) on all the topics covered in the first part of the course, with the aim to evaluate the knowledge and understanding of the topics. To overcome the trial, the student must acquire the 18/30 vote. If the test is insufficient, the student will repeat the
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essay as an oral examination at the end of the course.

- Written minitest consisting in the resolution of various exercises of different types related to microbiological analysis (dilutions, viable count in the CFU, etc.). The overcoming of the minitest is essential to pass the exam and allows the acquisition of 1-2 points.
- At the end of the course, an oral examination on the second part; to overcome the essay, the student must acquire the 18/30 vote

The final vote is the sum of the 3 trials.

The students not attending the course or who are unable to pass the written examinations will have to sit for an oral examination for throughout the course program.

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#### TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

- Galli Volonterio A. (2005) Microbiologia degli alimenti. Milano, Casa Editrice Ambrosiana
  - Burgeois C.M., Mesclé J.F., Zucca J., Microbiologia alimentare, Milano, Ed. Tecniche Nuove, (1990)
  - Farris G. A., Gobbetti M., Neviani E. (2012) Microbiologia dei prodotti alimentari, Milano, Casa Editrice Ambrosiana
  - Jay J.M, Loessner M.J, Golden D.A (2009) Microbiologia degli alimenti. Ediz. Ital. a cura di Pulvirenti A.. Ed. Springer
  - Ray B., Fundamental of food microbiology, London, CRC Press, (2004)
  - Tiecco G., Igiene e tecnologie degli alimenti, Bologna, Edagricole, (2001)
  - Zambonelli C., Papa F. Romano P., Suzzi G., Grazia L. Microbiologia dei salumi, Bologna, Edagricole, (1992)
  - Zambonelli C. (2001) Microbiologia degli alimenti fermentati Il Sole 24 Ore Edagricole
  - Vincenzini M., Romano P., Farris G.A. (Eds) "Microbiologia del vino", Edizioni CEA, Milano (2005)
  - Notes and teaching materials distributed during lessons, related to the course content not available in the textbooks.
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#### INTERACTIONS WITH STUDENTS

At the beginning of the course, program, structure, organization of the course and the evaluation procedure will be presented. Furthermore, the list and data of students attending the course will be drafted. During the lectures, teaching materials (shared folders, exercises, additional teaching materials) will be regularly provided to students who attend the course, by E-mail or by sharing a folder on Dropbox. The outcome of written examinations will be made available by E-mail.

The teacher will be available for receiving students indicatively at least 2 h a week (Tuesday and Thursday from 9:30 to 10:30). In addition, the teacher will be available by appointment via E-mail.

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#### EXAMINATION SESSIONS (TENTATIVE)<sup>1</sup>

8/07/2019, 9/09/2019, 7/10/2019, 11/11/2019, 9/12/2019, 13/01/2020, 3/02/20120, 9/03/2020, 13/04/2020, 11/05/2020, 8/06/2020, 6/07/2019, 7/09/2019.

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#### EVALUATION COMMITTEE

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

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SEMINARS BY EXTERNAL EXPERTS    YES X    NO

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#### FURTHER INFORMATION

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

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