Universidad Zaragoza

Academic Year/course: 2021/22

30804 - Microbiology

Syllabus Information

Academic Year: 2021/22
Subject: 30804 - Microbiology
Faculty / School: 105 - Facultad de Veterinaria
Degree: 568 - Degree in Food Science and Technology
ECTS: 6.0
Year: 1
Semester: Second semester
Subject Type: Basic Education
Module:

1. General information

1.1. Aims of the course

The general objective of this course is to learn general topics in Microbiology, virology, fungi and parasitology, which facilitates the understanding and construction of future knowledge in the disciplines of the degree. In addition, an attempt to stimulate students to actively participate in their learning process.

1.2. Context and importance of this course in the degree

Due to the basic nature of this subject, passing this discipline must enable students to follow advanced and specific courses of the degree.
It is advisable to have taken the biology courses in the bachellor (previous to the university).

1.3. Recommendations to take this course

It is advisable to have taken the biology courses in the bachellor (previous to the university).

2. Learning goals

2.1. Competences

The student will be competent to:

Manage information, search for sources, collection and analysis of information.
Use of ICTs.
Teamwork
Think and reason critically
Work autonomously and carry out a self-evaluation
Respect the diversity and plurality of ideas, people and situations.
Transmit information, orally and in writing
Show environmental sensitivity, assuming an ethical commitment.
Negotiate both with specialists in the area and with non-experts in the field
Adapt to new situations and solve problems

Undertake and be motivated by quality

Possess and understand knowledge in an area of ??study that starts from the base of general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that involve knowledge from the avant-garde of your field of study

Apply their knowledge to their job or vocation in a professional way and possess the kills they usually demonstrate through the development and defense of arguments and problem solving within their area of ??study

To have the ability to gather and interpret relevant data (usually within their area of ??study) to make judgments that include reflection on relevant issues of a social, scientific or ethical nature

transmit information, ideas, problems and solutions to both specialized and non-specialized audiences

To develop those learning skills necessary to undertake further studies with a high degree of autonomy

2.2. Learning goals

The student must demonstrate the following results:

Knowledge about microorganisms studied in the course

Able to define and properly use the scientific terminology used in Microbiology and Parasitology

Able to reinforce basic knowledge about eukaryotic and prokaryotic microorganisms

It is capable of differentiating the various types of microorganisms that are the object of study in Microbiology and Parasitology, with special attention to those related to food.

Able to differentiating microbial and parasitic diversity from the systematic, physiological and ecological fields

Able of defining the mechanisms used in their metabolism to carry out their activities

Able to interpret by what mechanisms they exchange genetic information among themselves and what this exchange of information reports to them

Able to know the characteristics of microbial growth and the alternatives for its control

Able to know the importance of the pathogenicity mechanisms possessed by the various microorganisms and parasites, since food acts as a vehicle for them and can cause illness in consumers.

Able to differentiate and assess the most common sterilization and sanitization techniques

Able to work in a team, synthesize the information available on a topic, present and substantiate his opinion on the matter and present it publicly and orally

2.3. Importance of learning goals

Together with the rest of the competences acquired, students will have the requested knowledge for advanced Microbiology courses of the degree, and will contribute to the performance of their professional profile. On the other hand, the generic and transversal competences adquired in this course will contributeto the comprehensive training of future Graduates in Food Science and Technology.

3. Assessment (1st and 2nd call)

3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

The student can decide about his/her assessment program. There are two types of assessments: continuous and global.

1. Continuous assessment:

It comprises of the following activities:

1. **Short- Typing test at the end of each lecture.** Students will fill out an online typing test in 5 min about the lecture. The test will include about 4-5 questions. The final grade of this assessment will be calculated using the average grade of all test and the number of proposed test. The grade of this activity constitutes 10 % de final grade.
2. **Two exams about theoretical knowledge**. The first exam comprises the first section of the course (General Microbiology). The examination date will be fix during the course in agreement with students. The second exam will be the remaining sections and it will be done in an official data fixed by Institution. Both exams will be typing test questions
3. **Exam about technical skills.** The exam comprises typing test questions in combination with short-development questions about the practical lessons. The examen data will be fix by the institution. Those students that did not attend to the practical lessons must perform a additional test in the lab.

4. **Group Work** that consists in the preparation of a review in topics related with microbiology and applied microbiology and its oral presentation. The group will be formed by about 5 students. The presentation data of each work will be informed during the course.

Assesment criteria:

1. **Short- Typing test.** This activity will be graded only if the student will perform at least half of the proposed tests. The grade received of this activity will constitute 10% of the final grade. It is not necessary a minimal grade in this probe to pass the course.
2. **Exam about theoretical knowledge**. It will be required to be graded at least as to pass both exams to pass the course. It is mandatory that each exam will be graded at least as 5 to pass the course. The average grade of both exams will constitute 50% of the final grade.
3. **Exam about technical skills.** It is mandatory be graded at least as 5 in this test to pass the course. The grade in this test will constitute 20% of the final grade. Students that do not attend to a practical session class should demonstrate that have all skills obtained during such session in an additional lab test.
4. **Group Work:** It is mandatory to be graded at least as 5 to pass the course. The grade of this activity will represent 20% of the final grade.

2. Global assessment

It comprises of the following activities:

1. **One exam about theoretical knowledge**. The exam will be about all theoretical lessons given during the course. The examination date will be fixed by Institution.It will be a typing test questions.
2. **Exam about technical skills.** The exam comprises typing test questions in combination with short-developmental questions about the practical lessons. The exam data will be fixed by the institution. Those students that did not attend to a practical lesson must perform an additional lab test in order to probe that the student got the technical skills.
3. **Group Work** that consists in a review about in a topic related to microbiology or applied microbiology. The group will be composed of about 5 students. The review will be orally presented in a data informed during the course.
4. **Exam about theoretical knowledge**. It is mandatory to be graded at least as 5 to pass the course will be required to pass the exams to pass the course. It is mandatory that each exam will be graded as 5 to pass the course. The average grade of both exams will constitute 60% of the final grade.
5. **Exam about technical skills.** It is mandatory be graded at least as 5 in this test to pass the course. The grade will constitute 20% of the final grade. Students that do not attend to a practical session class should demonstrate all skills taught during such session.
6. **Group Work:** It is mandatory be graded at least as 5 in this test to pass the course. The grade will be 20% of the final grade.

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The course is structured in 30 theory classes lasting one hour, 9 hours of seminars in which students, in small groups, prepare the topic, present it and answer related questions, and another 20 hours of laboratory practice.

The documentation of each topic is housed in the virtual campus of the university, i.e. Moodle 2 platform. Therefore, the student can have acces during the academic year. The available material includes the presentations of the concepts reviewed in class. In general, the profesor will stimulate students to participate through question-based learning.

The practices will be carried out in the laboratory in sessions of two hours. As in the theoretical part, the virtual course with the same name of the subject (open in the virtual campus of the university, in the Moodle 2 platform) will house the scripts and help on the realization of the practices.

For both the theoretical and practical sessions, the messaging and news system offered by the virtual course is used to maintain permanent contact with the students.

For individual and group work, all available information is provided to the student.

During the development of the classes, students will have to take into account all the procedures and rules included in the following documents:

- Prevention: A guide for students at the University of Zaragoza: https://uprl.unizar.es/sites/uprl.unizar.es/files/archivos/Procedimientos/guia_preventiva_para_estudiantes.pdf

- Manual de seguridad en los laboratorios de la Universidad de Zaragoza y normas marcadas por la Unidad de Prevención de Riesgos Laborales:

https://uprl.unizar.es/sites/uprl.unizar.es/files/archivos/Procedimientos/manual_de_seguridad_en_los_laboratorios_de_la_

https://uprl.unizar.es/inicio/manual-de-procedimientos

In addition, students will follow as well any instructions related to biosecurity given by the professor

4.2. Learning tasks

Theory program

BLOCK I. GENERAL BACTERIOLOGY

Microorganisms. Bacterial structures (cell envelope and intracelular structures). Techniques in Microbiology. Identification and clasiffication of bacteria. Bacteria Phisiology. Bacteria nutrition. Bacteria reproduction. Genetic, variation, and horizontal gene transfer. Virulence and pathogenicity. Control of bacteria populations: Physical agents, chemical and antibiotics.

Competences:

The objective of this first block is to introduce the student to the fundamentals of microbiology, including the general characteristics of bacteria and the bases of the techniques used in microbiology.

Teaching activities:

Master classes: 15 hours.

Practical classes in the laboratory: 13 hours dedicated to the management of bacteria.

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BLOCK II. SPECIFIC BACTERIOLOGY: FOODBORNE AND APPLIED MICROBIOLOGY

Bacteria Taxonomy. Bacteria of interest in Science and food technology, focused on those involved on food contamination and food Infection and applied microorganisms: *Acetobacter* y Gluconobacter. *Pseudomonas*. Coliformes. *Salmonella*, *Shigella*, *Yersinia enterocolitica*. *Plesiomonas*. *Campylobacter*. *Aeromonas*.*Vibrio*. Carnobacterium, Lactobacillus, Lactococcus y Leuconostoc. *Bacillus. Clostridium. Listeria. Staphylococcus. Micrococcus*. *Streptococcus*. *Enterococcus*.

The objective of this block is to provide knowledge about those bacteria related to foodborne and applied Microbiology and the mechanisms that each one of them develops to act on food and / or humans. The taxonomy of the microorganisms and the relationships between them is also considered in this block.

Teaching activities:

Theory classes: 7 hours

Practices classes: 3 h dedicated to bacteria identification

BLOCK III. GENERAL FUNGI, FOODBORNE AND APPLIED MICOLOGY

General features of fungi. Methods of growth and main fungy used in food industry. Micotoxins

Competences:

The objective of this block is to introduce the student to the general characteristics of fungi within the microbial world, their constitution, their observation, their culture, their metabolism, their mechanisms for exchanging information between them and their role in relation to food. and the man

Teaching Activities

Theory classes: 2 hours

Practices classes: 2 h dedicated to fungy identification

BLOCK IV. GENERAL VIROLOGY AND FOODBORNE

Virology and concepts. Virus Structure. General Features of virus replication. Destruction of virus. Culture, cuantification and identification. Classification of virus. Food and waterborne viruses. Bacteriophages. Other infective agents.

Competences:

The objective of this block is to learn general characteristics of viruses within the microbial world, their constitution, their observation, their culture, their replication, and their role in foodborne diseases.

Teaching Activities:

Theory class: 2 horas.

BLOQUE V. GENERAL PARASITOLOGY AND FOODBORNE

Biological relationship of Parasitism. Parasites Spread of parasites. Biological cycles. Parasite / host relationship. Systematics and taxonomy. Classification of parasites. Protozoa, helminths and arthropods: General characters, classification, study of the most important genera in relation to food and human.

Competences:

The objective of this fourth block is to introduce the student to the general characteristics of the biological relationship of parasitism within the microbial world, morphology and biology of parasites, the parasite-host-environment relationships and their role in relation to food and the man.

Teaching Activities:

Theory Classes: 4 hours

Practice clases: 2 hours dedicated to parasite identification.

PRACTICE PROGRAM:

It involves 5 sessions of about 4 hours each, throughout the semester. The content of the practical sessions is as follows:

1. Working rules in the Microbiology laboratory. Material and appliances of normal use. Sterilization systems, preparation of culture media. Observation of samples. Simple staining.

2. Preparation of samples. Culture of microorganisms: Aerobic and anaerobic. Types of cultures. Gram staining.

3. Quantitative study of bacterial populations. Biochemical study of microbial activity for the identification of bacteria.

4. Immunological Reactions for the identification of microorganisms.

5. Identification of fungi, yeasts and parasites.

4.3. Syllabus

The course will address the following topics:

Topic s

Section I. MICROBIOLOGY

- Topic 1. Introduction to Microbiology for CTA.
- Topic 2. Prokaryotic and eukaryotic organisms.
- Topic 3. Constant elements of bacteria.
- Topic 4. Inconstant elements of bacteria.
- Topic 5. Microscopic examination of bacteria.
- Topic 6. Chemical constitution of bacteria.
- Topic 7. Bacterial physiology.
- Topic 8. Bacterial metabolism for synthesis.
- Topic 9. Bacterial nutrition.
- Topic 10. Bacterial reproduction.
- Topic 11. Criteria for classification and identification of bacteria.
- Topic 12. Bacterial genetics.
- Topic 13. The genetic transfer phenomena.
- Topic 14. Bacterial factors.
- Topic 15. Physical and chemical agents that act on the life of microorganisms.
- Topic 16. Bacterial taxonomy.
- Topic 17. *Acetobacter* and *Gluconobacter*. *Pseudomonas* (*P. aeruginosa*).

- Topic 18. Coliforms.
- Topic 19. *Salmonella*, *Shigella*, *Yersinia enterocolitica*. *Plesiomonas* (*P. shigelloides*).
- Topic 20. *Campylobacter* (*C. coli, C. jejuni*). *Aeromonas* (*A. hydrophila*). *Vibrio* (*V. cholerae, V. parahaemolyticus*).
- Topic 21. *Carnobacterium*, *Lactobacillus*, *Lactococcus* and *Leuconostoc*.
- Topic 22. *Bacillus cereus*. *Clostridium* (*C. perfringens, C. botulinum*). *Listeria monocytogenes*.
- Topic 23. *Staphylococcus aureus* (*S*. coagulase +). *Micrococcus*. *Streptococcus*. *Enterococcus*.

Section II. MYCOLOGY

- Topic 24. Mycology. General characteristics of fungi.

Section III. VIROLOGY

- Topic 25. General virology.
- Topic 26. Bacteriophages.

Section IV PARASITOLOGY

- Topic 27. General considerations on the study of parasites.
- Topic 28. Overview protozoa.
- Topic 29. Overview of helminths.
- Topic 30. Overview of arthropods as contaminants of animal- and vegetable-derived foods.

Practical sessions

- Session 1: The laboratory of microbiology. Culture media. Optical microscopy. Basic stains.
- Session 2: Sampling, plating techniques, interpretation of bacterial growth. Specific stains.
- Session 3: Quantitative study of bacterial populations and identification of bacteria.
- Session 4: Serological diagnostic techniques.
- Session 5: Characterization and identification of fungi and parasites.

4.4. Course planning and calendar

Schedule of lectures, paper presentations and exams

The dates and key milestones of this subject are described in detail, along with the other subjects of the second semester of the first year in the "Programme for the 2nd quarter of the 1st year of CTA" held in the Faculty of Veterinary Medicine website.

Planning MICROBIOLOGÍA subject in ECTS

Credits: 6 ECTS (150 hours of student work)

Students and groups: 60 students, one group of theoretical teaching and 6 of practical teaching.

Experimentality factor: 3

4.5. Bibliography and recommended resources

- Acha, Pedro N. Zoonosis y enfermedades transmisibles comunes al hombre y a los animales. Volumen III, Parasitosis / Pedro N. Acha, Boris Szyfres. 3a ed. Washington, D.C.: Organización Panamericana de la Salud, 2003
- Brock: Biología de los microorganismos / Michael T. Madigan... [et al.]; coordinación Ricardo Guerrero ; traducción Coral Barrachina ... [et al.]; revisión técnica, Francisco Ruiz Berraquero. - 12ª ed., reimp. Madrid [etc.]: Pearson Education, D. L. 2011
- Euzéby, Jacques. Los parásitos de las carnes: epidemiología, fisiopatología, incidencias zoonósicas / Jacques Euzéby ; traducido por, Caridad Sánchez Acedo [et al.] . Zaragoza: Acribia, 2001
- Gállego Berenguer, Jaime. Manual de parasitología: morfología y biología de los parásitos de interés sanitario / Jaime Gállego Berenguer. [2a. ed.] Barcelona: Edicions Universitat de Barcelona, D.L. 2003.
- Meaney, Peter. Insect pests of food premises /by Peter Meaney. Caerphilly: National Britannia Ltd., 1998
- Mossel, David Alexander Antonius. Microbiología de los alimentos: Fundamentos ecológicos para garantizar y comprobar la integridad (inocuidad y calidad) microbiológica de los alimentos / D.A.A. Mossel, B. Moreno García y Corry B. Struijk . 2ª ed. Zaragoza: Acribia, 2003
- Parasitism: the diversity and ecology of animal parasites / Albert O. Bush. Cambridge : Cambridge University Press, 2001
- Prescott, Lansing M.. Microbiología / Lansing M. Prescott,John P. Harley, Donald A. Klein ; [traducción, Carlos Gamazo de la Rasilla , Iñigo Lasa Uzcudum]. 5a. ed., [traducción de la 5a ed. inglesa] Madrid [etc.] : McGraw-Hill , 2004
- Roberts, Larry S. Gerald D. Schmidt & Larry S. Roberts' foundations of parasitology /Larry S. Roberts, John Janovy.

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- Tortora, Gerard J. Introducción a la microbiología / Gerard J. Tortora, Berdell R. Funke, Christine L. Case. - 9ª ed. Buenos Aires [etc.] : Editorial Médica Panamericana, cop. 2007
- Willey, Joanne M.. Microbiología / Joanne M. Willey, Linda M. Serwood, Christopher J. Woolverton. 7ª ed. (3ª ed. en español) Madrid [etc.]: McGraw-Hill, cop. 2009