Universitat de Lleida

DEGREE CURRICULUM

MICROBIOLOGY

Coordination: TORRES GRIFO, MERCE

Academic year 2023-24

MICROBIOLOGY 2023-24

Subject's general information

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<tr><td>Subject name</td><td>MICROBIOLOGY</td></tr>
<tr><td>Code</td><td>102214</td></tr>
<tr><td>Semester</td><td>2nd Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
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<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Food Science and Technology</td><td>1</td><td>COMMON/CORE</td><td>Attendance-based</td></tr>
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<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
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<tr><th>Activity type</th><th>PRALAB</th><th>PRAULA</th><th>TEORIA</th></tr>
<tr><td>Number of credits</td><td>2</td><td>0.4</td><td>3.6</td></tr>
<tr><td>Number of groups</td><td>4</td><td>2</td><td>1</td></tr>
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<tr><td>Coordination</td><td>TORRES GRIFO, MERCE</td></tr>
<tr><td>Department</td><td>FOOD TECHNOLOGY, ENGINEERING AND SCIENCE</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>Hores presencials: 60
Hores no presencials: 90</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>Catalan: 90
English: 10</td></tr>
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MICROBIOLOGY 2023-24

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
TORRES GRIFO, MERCE	merce.torres@udl.cat	8,4	
TORRES SANCHIS, MARIA ROSARIO	mariarosario.torres@udl.cat	4	

Learning objectives

- Be aware of the constant presence in our environment of microorganisms

- Differentiate the members of the microbial world and compare different cellular organizations

- Getting used to the routine microbiology laboratories

- Observe, differentiated and enumerated microorganism

- Use the main techniques of microbial cultere

- Define microbial growth and justify the parameters that influence

- Explain the bacterial reproduction and determine the mechanisms of genetic variability in prokaryotes

- Recognize the basic principles of recombinant DNA technology. Identify the necessary devices for cloning

- Integrate the bases of bacterial classification

- Specify the archaea and the bacteria related to food microbiology and industrial microbiology

- Distinguish the main fungi related to food and industrial mycology

- Describe the subcellular particles capable of producing diseases

- To express the concept of microbial death and physical and chemical agents applied in microbial control.

Competences

Basic competences (BC), General Competences (GC), Transversal Competences (TC)

BC1: Comprehend the general knowledge acquired in secondary education including advanced cutting-edge knowledge in the field.

BC2: Apply knowledge into practice in a professional setting and have the necessary skills for argumentation, defence and problem solving within the field.

BC3: Gather and interpret relevant data to make judgements involving a reflection on related social, scientific and ethical issues.

BC4: Convey comprehensive information, ideas, problems and solutions both to specialised and non-specialised audiences.

GC1: Analyse specific situations, identify problems, make decisions and implement action plans in search for solutions.

GC2: Interpret studies, reports and data and analyse them numerically.

GC3: Select and manage available written and computerised sources of information related with the professional activity.

TC1: Be able to comprehend and express concepts using the proper terminology.

TC4: Respect the fundamental rights, equality between men and women, the promotion of the human rights and the values of peace la and democracy.

- **Basic Sciences**

CE3: Know and be able to apply the biology and human physiology fundamentals needed to develop the professional activities and other disciplines.

CE5: Know the basic processes of a lab, be able to use lab equipment, work with reagents, comply with safety regulations and draw reports.

CE6: Be able to pose and solve problems applying the concepts learnt to specific situations.

- **Food safety**

CE40. Use the food microbiological analysis techniques

CE41. Carry out the chemical, physical, microbiological and sensory analyses for food evaluation.

Subject contents

LESSON 1. THE HISTORY AND SCOPE OF MICROBIOLOGY

The discovery of Microorganisms. The spontaneous generation conflict. The recognition or the microbial role in disease. The discovery of microbial effects in organic and inorganic matter. Microbiology today. The scope and relevance of microbiology

LESSON 2. AN OVERVIEW OF THE MICROBIAL WORLD

Elements of cellular and viruses organization. And overview of prokaryotic and eukaryotic structure. Prokaryotic diversity. The tree of life.

LESSON 3. PROKARYOTIC CELL STRUCTURE AND FUNCTION

Size, shape, and arrangement. Prokaryotic cell membranes and cell walls. Capsules, flagella, pili and fimbriae. The cytoplasmic matrix, ribosomes and inclusion bodies. The nucleoid.

LESSON 4. THE BACTERIAL ENDOSPORE

Introduction. Sporulation process and endospore structure. Resistance of endospores to external agents. Germination.

LESSON 5. MICROBIAL NUTRITION AND METABOLISM

The common nutrient requirements. Growth factors. The role of the oxygen. Bacteria nutritional categories. Culture media. Isolation of pure cultures. The influence of environmental factors of growth.

LESSON 6. MICROBIAL GROWTH

Definition and mathematics of growth. The growth curve. Diauxic growth. Measurement of microbial growth. The continuous culture of microorganisms: the chemostat.

LESSON 7. BACTERIAL GENETICS

Characteristics of bacterial DNA. Replication, transcription and protein synthesis. Gen structure. Mutation and their chemical basis. Mutagenic agents. Detection and isolation of mutagens. DNA repair.

LESSON 8. GENE TRANSFER IN BACTERIA

Importance of the transfer of genes. DNA transformation. Bacterial conjugation. Transduction.

LESSON 9. RECOMBINANT DNA TECHNOLOGY

Historical perspectives. Devices for cloning. Restriction endonucleases. DNAS ligases. Cloning vectors: plasmids, phage vectors and cosmids. The polymerase chain reaction.

LESSON 10. MICROBIAL TAXONOMY

General introduction and overview. Classification systems. Taxonomic ranks. Species rank. Bergey's Manual of Systematic Bacteriology. Major taxonomic groups related to food microbiology, hygiene and industrial microbiology.

LESSON 11. THE *ARCHAEA*

Introduction to the *Archae.* The methanogens. The halobacteria. The thermoacidophiles.

LESSON 12. *BACTERIA:* THE PROTEOBACTERIA

Pseudomonas. Acetic acid bacteria. Enterobacteria. *Vibrio* and *Photobacterium. Campylobacter* and *Helicobacter.*

LESSON 13. *BACTERIA:* GRAM POSITIVES

The Clostria and relatives. The Bacilli and Lactobacilli. *Listeria monocytogenes.* The high G+C Gram positives: Corynebacteria and propionic acid bacteria, *Mycobacterium, Streptomyces. Bifidobacterium.*

LESSON 14. THE FUNGI

Distribution. Importance. Structure. Nutrition and metabolism. Reproduction. Fungal divisions.

LESSON 15. THE VIRUSES

Early development of Virology. General properties of viruses. The structure of viruses. Principles of virus taxonomy. Reproduction of viruses: adsorption and penetration; synthesis of virus nucleic acids and proteins; assembly and release. Temperate bacteriophages and lysogeny.

LESSON 16. VIROIDS AND PRIONS

Chemical nature of viroids and prions. Plant diseases caused by viroids. Degenerative nervous system disorders caused by prions.

LESSON 17. CONTROL OF MICROORGANISMS

Importance of microbial control. Definition of frequently used terms. Conditions influencing the effectiveness of antimicrobial agent activity.

LESSON 18. PHYSICAL METHODS IN CONTROL

Heat. Low temperature. Filtration. Radiation.

LESSON 19. CHEMICAL AGENTS IN CONTROL

Phenolics. Alcohols. Halogens. Heavy metals. Quaternary Ammonium Compounds. Aldehydes. Sterilizing gases. Antibiotics.

Methodology

Activity	Description	Classroom activity		Learning activity		Evaluation	Time total/ECTS
		Objectius	Hores	Treball alumne	Hores	Hores	Hores
Lecture	Lectures (large group)	Explanation of the main concepts	**31**	Study: Know, understand and knoledge synthesis	**45**	4	**80/3.2**
Seminars	Class participation (middle class group	Carrying out activities for discussion and application	**9**	Solving cases. Discussing	**16**		**25/1**
Laboratory	Laboratory practice (middle class group)	Understanding phenomena, measuring, ...	**20**	Studying and making reports	**25**		**45/1.8**
Totals			**60**		**86**	4	**150/6**

Development plan

The development of this subject will be mainly theory classes, laboratory practical classes and seminars. Theory classes will be done during the programmed timetable for this subject, and will be mainly expositive. For some lessons, a Directed Activity will be also proposed; in this case, the student will do an activity following specific instructions. Theory knowledge will be amplified with the analysis of some example cases.

Laboratory practical classes are mandatory; therefore, they must be performed in order to pass this subject. The practical classes will be performed intensive during one week

The following individual protection equipments (EPIs) are mandatory. Students have to wear them during practical classes:

- Unisex white labcoat.
- Biological / Chemical protection gloves.

Evaluation

Activity	Evaluation activity		Rating
	Procedure	Number	(%)
Lecture	Exams	2	**50 % (25+25)**
Seminars	Reports, oral and writting work or wratting test	2	**20% (10+10)**
Laboratory	Reports, attidtude and aptitude	2	**30**
Other			
Total			**100**

In the evaluation, three blocks are considered:

BLOCK 1: Theory (50%)

Exam 1 (2.5 points)

Exam 2 (2.5 points)

To pass the evaluation you must obtain 50% of the score of this category.

BLOCK 2: Practices (30%)

They are the laboratory practices (3 points). They are compulsory and must be done on the date programmed in the academic calendar. Non-attendance will be penalized with less 0.1 points / hour not attended.

To evaluate them, a Rubric is used, published on the Virtual Campus, where the different laboratory practices are graded (there are several scoring activities, not all with the same value). Failure to attend during the realization and / or reading of any of the practices will imply a zero in that practice.

BLOCK 3: Assignments (20%)

Work 1 (1 point): It is done in class in a puzzle-type activity.

Work 2 (1 point): Presentation in hours of seminars of a study carried out in group.

To pass the subject it is essential (a + b + c)

a. Have obtained ≥ 50% of BLOCK 1
b. Have attended the practical sessions (a minimum of 80%)
c. Have obtained ≥50% of the overall grade

If an essential block of the subject has not been passed but the average of all the qualifications is greater than 5, the record will include fail (4.9)

ALTERNATIVE ASSESSMENT

BLOCK 1: Theory (50%)

An exam that will be held on the day that the academic calendar has planned for the recovery exam. If you do not pass this test there will be the option of a recovery exam that will be done between 3 and 10 days after the last exam scheduled in the academic calendar.

To pass the evaluation you must obtain 50% of the score of this category.

BLOCK 2: Practices (30%)

They are the laboratory practices (3 points). They are compulsory and must be done on the date programmed in the academic calendar.

BLOCK 3: Assignments (20%)

They can be delivered on the scheduled date for the activity or on the day of the exam. There will be no need for an exhibition, only presentation of the document.

If an essential block of the subject has not been passed but the average of all the qualifications is greater than 5, the record will include fail (4.9)

Bibliography

Basic bibliography

MADIGAN, M.T., MARTINGO, J.M. et al. 2015. “Brock. Biología de los Microorganismos” 14 ed. Pearson Educación, S.A.

SINGLETON, P. 2004. “Bacterias en Biología, Biotecnología y Medicina”. Acribia.

WILLEY, J.M.; SHERW OOD, L.M.; W OOLVERTON, C.J.. 2009. "Microbiología" de Prescott, Harley y Klein 7 ed. McGraw-Hill.

Further reading

ALLAERT, C. I ESCOLÀ, M. 2002. “Métodos de análisis microbiológicos de los alimentos” Diaz de Santos

BERGEY’S MANUAL OF SYSTEMATIC BACTERIOLOGY. Volums 1, 2, 3 i 4. Garrity, G.M. Editor. Springer. Volum 1: 2001

SAMSON, R.A.; HOEKSTRA, E.S.; FRISVAD, J.C. i FILTENBORG, O. 2004. “Introduction to food- and airbone fungi” 7a ed. Centraalbureau voor Schimmelcultures.