Universitat de Lleida

DEGREE CURRICULUM

MICROBIOLOGY I

Coordination: DE LA TORRE RUIZ, M. ANGELES

Academic year 2023-24

MICROBIOLOGY I 2023-24

Subject's general information

<table>
<tr><td>Subject name</td><td>MICROBIOLOGY I</td></tr>
<tr><td>Code</td><td>101613</td></tr>
<tr><td>Semester</td><td>1st Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
<table>
<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Biotechnology</td><td>2</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
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</td></tr>
<tr><td>Course number of credits (ECTS)</td><td>7.5</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><td>PRALAB</td><td colspan="2">PRAULA</td><td>TEORIA</td></tr>
<tr><th>Number of credits</th><td>2</td><td>0.4</td><td>0.4</td><td>4.7</td></tr>
<tr><th>Number of groups</th><td>4</td><td>2</td><td>1</td><td>1</td></tr>
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</td></tr>
<tr><td>Coordination</td><td>DE LA TORRE RUIZ, M. ANGELES</td></tr>
<tr><td>Department</td><td>BASIC MEDICAL SCIENCES</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>75 contact/ on-line hours
112.5 hores individual work</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 10%
Spanish 90%</td></tr>
<tr><td>Distribution of credits</td><td>40 h lectures
20 h practices in the lab
4 h problems
4 h bioinformatics
7 h seminars</td></tr>
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MICROBIOLOGY I 2023-24

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
COLOMINA GABARRELLA, M. NIEVES	neus.colomina@udl.cat	1	
DE LA TORRE RUIZ, M. ANGELES	mariaangeles.delatorre@udl.cat	4,9	
MONTELLÀ MANUEL, SANDRA	sandra.montella@udl.cat	4	
PUJOL CARRION, NURIA	nuria.pujol@udl.cat	4	

Subject's extra information

The Microbiology I course has been designed as an introductory course in the knowledge of the microbial world.

The fundamental aspects of the microbial world will be studied, from the molecular, physiological, evolutionary, biochemical, structural, taxonomic, ecological and biological points of view. It is about giving a vision of microorganisms as a tool and basic study material in Biotechnology.

The student will need to have knowledge of Biochemistry, Chemistry, Informatics and Cell Biology acquired during the first year of the Biotechnology and Genetics degree, a subject that will be taught in parallel with Microbiology I.

For a good use of this subject it is recommended to have passed the subjects of the first course Biochemistry, Molecular Biology, General and Organic Chemistry and Cell Biology For any consultation, it is recommended to previously contact the teachers via e-mail (the address that appears on the file), through SAKAI virtual space, redirecting to the mail on the file or alternatively by phone.

Learning objectives

To pass the subject, the student should be able to:

1. Knowing the basics of the structure, biochemistry, molecular microbial physiology and genetics.

2. To demonstrate knowledge of the importance that microorganisms have on human health.

3. To demonstrate knowledge of evolutionary development of the microbial world and their possible biotechnological application along with comparative genomic analyses.

4. To know the main concepts of microbial ecology.

5. To demonstrate knowledge about the main microbial models and their interaction with other living beings.

6. Resolving cases and problems related to the use of microorganisms as biotechnological tools.

7. To demonstrate knowledge about the operation of a microbiology laboratory and about physiological, genetic and molecular manipulation of some model microorganisms.

Competences

General skills Graduates in Biotechnology must have:

CG1• Being able to search and selectively use information sources needed to achieve the training objectives.

CG2• To interpret the scientific and technical information with a critical sense, and being able to make presentations based on this information.

CG3• Teaming up with a multidisciplinary approach and ability to make a rational and efficient distribution of tasks between team members.

CG4• To know and properly use their own scientific and technical vocabulary of the different areas of biotechnology.

CG5• Working in the laboratory using criteria of quality and good practice.

CG6• To know and to use the software and specific databases in different areas of biotechnology.

CG7•To use the scientific method to analyze data and design experimental strategies biotechnological applications.

CG9 Being able to carry out a professional activity in accordance with safety regulations and respect for the environment and with ethical criteria.

CG8• Being able to form a critical judgment about the implications of biotechnology to ethical, legal and environmental level.

CG10• To convey strategies and technological applications in the enterprise, based on the general fundamentals of business economics.

CT2• Being able to communicate at the international level in their professional development (Strategic competence of UDL)

CT1• Being able to make understandable written and oral reports on the work done, with a justification based on the theoretical and practical knowledge gained (Strategic competence of UDL).

CT3• To use tools and techniques of information and communication for data analysis and preparation of oral and written reports and other training and professional activities (Strategic competence of UDL)

CT4• To respect the fundamental rights of equality between men and women, the promotion of human rights and values ??of a culture of peace and democratic values ??(Strategic competence of UDL).

Specific skills (According to the document Curriculum)

CE23 To understand the fundamental aspects of the structure, metabolism, genetics and ecology of prokaryote and eukaryote microorganisms related to possible technological use of them.

CE24 To know the principles of the immune response at the molecular, cellular and physiological level, and the use of antigen-antibody reactions at the analytical and diagnostic level.

CE25 To know the practice of microbial cell culture.

CE32 Know the use of animal, plant and microbial cells in biotechnological processes.

Subject contents

MICROBIOLOGY I 2023-24

According to the Syllabus: Microorganisms: structure, function, metabolism and ecology. Microbial Molecular Biology, Genetics and Microbiology. Microbiological techniques. Microbial Ecology. Microorganisms of biotechnological interest. Applications of Microbiology in the world of Biotechnology.

LECTURES. It will be required to obtain a minimal grade of 5,5/10 in this part to pass the complete subject. The average between the two examens will be not be calculated with a score lower that 5/10 in one of them.

Unit 1. **INTRODUCTION**. Concept and historical development of Microbiology as a science

Unit 2. **THE MICROBIAL CELL.** The prokaryotic cell. The eukaryotic microbial cell: algae, fungi, protozoa. Microbial samples microscopy and staining techniques.

Unit 3. **MICROBIAL NUTRITION AND GROWTH.** Microbial nutrition: requirements of carbon, phosphorus, nitrogen and sulfur. Growth factors. Variety of nutrient uptake. Culture media. Pure crops. Growth curve: phases, counts of total and viable cell numbers. Continuous cultivation. Environmental factors. Microbial growth in the natural environment.

Unit 4. **MICROBIAL GENETICS.** Mutations and mutagenesis. SOS system: detection mechanisms and DNA damage. Two-component systems. Microbial cell cycle. Genetic variability: microbial genetic exchange mechanisms. Bacterial Conjugation. Microbial transformation. Transduction. Cloning Vectors. Transposons. Integrons. Gene expression in microorganisms. Microbial genomics. General characteristics of microbial genomes. Microbial proteomics. Evolution.

Unit 5. **MICROBIAL METABOLISM**. Basics of microbial metabolism. Microbial anabolism and catabolism. Chemiolitotrophy. Phototrophy. Anaplelotic reactions. Biosynthesis of the cell wall.

Unit 6. **CONTROL OF MICROBIAL GROWTH.** Action of physical agents. Action of chemical agents. Antibiotics. Other antimicrobial chemotherapeutic agents. Microbial resistance to drugs.

Unit 7. **MICROBIAL ECOLOGY.** Microorganisms in the world: Microbial ecosystems. Interactions microorganisms-biosphere, microorganisms-plants, microorganisms-animals. Microbial intervention in nutrient cycles. Biofilms and biotechnology implications. Microbial ecology of the human body: positive and negative interactions. Toxins and mechanisms of microbial toxicity. Infection and defense mechanisms of the human body. Vaccines

Unit 8. **HUMAN UTILIZATION OF MICROORGANISMS. BIOTECHNOLOGICAL APPLICATIONS DERIVED FROM MICROORGANISMS**. Applications of microbial biotechnology. Most relevant products in Biotechnology obtained from microbial activity: drugs (insulin antibiotics, vaccines), amino acids, organic acids, surfactants, biopolymers. Microbial enzymes. Transgenic plants. Bioinsecticides. Bioremediation. Biodeterioration.

PRACTICAL ACTIVITIES:

PRACTICES IN THE COMPUTER CLASSROOM (4h)

Oligonucleotide design to amplify genes of interest. Management of microbial databases. In silic cloning. Manipulation and interpretation of cloning vectors.

TUTORIZED SEMINARS: (7h) A possible list of topics to be chosen by the students (to be carried out by each of the work groups) is exposed. At the end of the course, each group will publicly present the chosen topic. Attendance will be obligatory to obtain the score of this activity. Each student will obtain a group grade (50%) and an individual grade (50%)

LABORATORY PRACTICES: (attendance to this part will be compulsory to obtain the complete grading of this part)

Practice 1: Preparation of culture media for the isolation of bacteria and fungi. Sterilization techniques and preparation of laboratory material.

Practice 2. Microorganism staining techniques. Microscopy.

Practice 3. Selection of solid culture media to identify Gram + and Gram- bacteria

Practice 4. Identification of Enterobacteria through a gallery of biochemical tests

Practice 5. Extraction of a bacterial plasmid by using a commercial kit, visualization of DNA (electrophoresis). Transformation of bacteria and selection of plaque recombinants. Evidence of genetic recombination from the expression of beta-galactosidase.

Practice 6. Genetics of yeasts. Sexual reproduction and Mendelian segregation of a dominant character.

Practice 7. Microbial growth curve.

Practice 8: Antibiogram

Practice 9: Isolation and identification of certain bacteria that inhabit the human body and possible pathogens

Practice 10: Detection of some mechanisms of bacterial toxicity

PROBLEMS AND CASES (4h)

Various exercises and discussion of them will be carried out, all aimed at understanding and deepening the theoretical and practical topics of the subject. This will be a team-work. each member will obtain the same team grading.

Methodology

Tipus d'activitat	Descripció	Activitat presencial alumne		Activitat no presencial alumne		Avaluació	Temps total
		Objectives	**Hours**	**Student work**	**Hours**	**Hours**	**Hours**
Mastre Class	Master Class. Big Group. On-line	Explanation of the main concepts	**40**	Study: To know, to understand and to synthesize knowledge	**91.5**	3	**134.5**
Ploblems and cases	Participatory class.	Resolution of Problems and Cases	**4**	To learn to solve problems and cases	**4**	**1**	**9**
Seminari	Participatory class. Team work. Writeen and oral excercise. On-line	To performs activities of discussin and aplication of theorethical concepts.	**6**	To solve problems. To discuss.	**12**	0.5	**18.5**
Laboratory	Laboratory Practice Medium group Team-work	Performance of the Practice. To understand phanomena, to measure	**21**	To understand, to discuss and to study.	**3**	1	**24**
Computer Class	Computer practice.	Performance of the Practice. To understand phanomena, to measure	**4**	Estudiar i Realitzar memòria	**2**	0.5	**6.5**
Directed activities	**Student work (individual and in group)**	To guide the student to work	**1**	To carry out a Bibliographical work.	**15**		**12**
Others							

Total			**75**		**112.5**	6	**193.5**

Evaluation

Exams	Problems	Laboratory	Seminars	Bioinformatics
50%	5%	25%	10%	10%

Type of Activity	Evaluation of the activity		% Evaluation
	Procedure	**Número**	
Lectures	Written exam based on the theorethical program of the subject. Tho pass the subject the student will have to obtain a minimal grade of 5,5/10 in this activity. Average between both exams only will be done with scores equal or over 5/10.	1	**50**
Problems	Written exercise based on the application of theoretical concepts	1	**5**
Laboratory	Written exercise based on the experimental work developed in the laboratory It will be compulory to obtain a minimum grade of 5,5/10 in this activity to pass this subject	1	**25**
Seminar	Written/Oral tests	1	**10**
Informàtics	Written test	1	**10**
Total			**100**

ALTERNATIVE EVALUATION

Students who take the alternative assessment must take a single exam that will coincide with the date and time of the exam scheduled for the second assessment, in the schedule published for the subject. This exam will account for 50% of the mark. In this exam all the theoretical knowledge of the subject will be evaluated. On the same day, the student will take the practice exam, which will be independent from the theory exam and will account for 25% of the final grade.

Attendance to problem classes and seminars is not mandatory, therefore the student can decide whether to attend or not, however, since the grade is from the group, if the student does not attend, they will not be able to obtain the percentage of the grade corresponding to these activities and therefore the maximum final grade to which you will be able to choose will be 75%, that is to say, 7.5. Alternative activities to non-compulsory activities will not be carried out.

The date of recovery of the alternative evaluation will be the same as the scheduled date for recovery in the schedule published for the subject

Bibliography

Basic Bibliography

- M.T. Madigan, J.M. Martinko y J. Parker. Biología de los Microorganismos. Addison-Wesley, Madrid .
- Prescott, Harley y Klein. Microbiología. McGraw-Hill Interamericana, Madrid.
- Willey, Sherwood and Woolverton. Prescottt´s principles of Microbiology. McGraw-Hill Interamericana, Madrid.
- Salyers and D.D. Whitt. Microbiology: Diversity, Disease and the Environment. Fitzgerald Science Press, Bethesda, Maryland.

Complementary Bibliography

- B. R. Glick and J.J. Pasternak. Molecular Biotechnology. Principles and applications of recombinant DNA. ASM Press, Washington.
- Hurst, C.J., Crawford, R.L., Garland, J.L., Lipsin, D.A., Mills, A.L. and Stetzenbach, L.D. Manuel of Environmental Microbiology. ASM, Press.
- Martin Dworkin. The Prokariotes. Springer.
- A.H. Varnam. Environmental Microbiology. ASM Press, Washington.
- J.L. Ingraham, J.L. y C.A. Ingraham, C.A. Introducción a la Microbiología (2 vols.). Editorial Reverté, Barcelona.