

Microbiology

Code: 102798
ECTS Credits: 3

Degree	Type	Year	Semester
2501915 Environmental Sciences	OB	1	1

Contact

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Use of languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Prerequisites

There are no official prerequisites to follow the course; nonetheless it would be desirable if students review basic concepts of the microbial world previously acquired and a good knowledge about the subjects coursed simultaneously in the first semester.

Students must have passed the biosafety and security laboratory tests to attend the Practical Lab classes, and be knowledgeable and accept the laboratories regulations of the *Facultat de Ciències*. **For safety reasons, if the two tests have not been exceeded or no lab coat is taken, access to the test will not be allowed.**

Objectives and Contextualisation

Contextualisation

This is a compulsory subject, nuclear course from the degree of Environmental Sciences, which introduces students into the microbial world, giving a general vision of the microorganisms, in connection with other higher organisms, and also with the different environments where they live.

This course offers the basic concepts and competencies in Microbiology so that the student can go more into depth in the Microbiology field in the following years.

Objectives of the subject:

- To broadly recognize microbial diversity and to know how to distinguish the characteristics that define the different microbial groups.
- To know the role of microorganisms in the development of human societies, as well as their future applications.
- To identify the different structures, as well as the composition of the prokaryotic cell.
- To know the genomic variability of the microorganisms and the main mechanisms of exchange of genetic information in prokaryotes.
- To know the metabolic versatility of the different microbial groups, particularly that of prokaryotes.
- To recognize the main relationships of microorganisms with living organisms and with the physical

- environment they inhabit.
- To understand and apply basic laboratory techniques to work experimentally with microorganisms.
- To know how to perform basic calculations to determine microbiological parameters.

Skills

- Adequately convey information verbally, written and graphic, including the use of new communication and information technologies.
- Analyze and use information critically.
- Collect, analyze and represent data and observations, both qualitative and quantitative, using secure adequate classroom, field and laboratory techniques
- Demonstrate adequate knowledge and use the most relevant environmental tools and concepts of biology, geology, chemistry, physics and chemical engineering.
- Demonstrate concern for quality and praxis.
- Demonstrate initiative and adapt to new situations and problems.
- Learn and apply in practice the knowledge acquired and to solve problems.
- Quickly apply the knowledge and skills in the various fields involved in environmental issues, providing innovative proposals.
- Teaming developing personal values regarding social skills and teamwork.
- Work autonomously

Learning outcomes

1. Adequately convey information verbally, written and graphic, including the use of new communication and information technologies.
2. Analyze and use information critically.
3. Analyze the most relevant of genetics and microbiology environmental aspects.
4. Demonstrate concern for quality and praxis.
5. Demonstrate initiative and adapt to new situations and problems.
6. Identify organisms and biological processes in the surrounding environment and evaluate them properly and originally.
7. Learn and apply in practice the knowledge acquired and to solve problems.
8. Observe, recognize, analyze, measure and properly and safely represent organisms and biological processes.
9. Recognize the world of microorganisms and assess the environmental relevance.
10. Teaming developing personal values regarding social skills and teamwork.
11. Work autonomously

Content

Theoretical Content

Unit 1. The microbial world

The history of microbiology. Levels of organization. Microbial diversity.

Unit 2. Studying microorganisms

Observation and cultivation of microorganisms. Fixation and staining. Sowing and isolation. Sterilization and conservation.

Unit 3. The viruses.

Concept of virus. Composition, structure and morphology of viruses. Morphology of viral. Virus-host cell relationships: Viral cycle. Classification and diversity of viruses. Other subcellular infectious agents. Main differences between viruses and cellular organisms.

Unit 4. The prokaryotic cell: Cytoplasm and cellular envelopes

Prokaryotic and eukaryotic organization. Size and morphology. Cytoplasm and Nuclear region. Functional and reserve inclusions. Cytoplasmic membrane. Structure and function of the cell wall. Capsules and mucous layers.

Unit 5. Cellular appendices and microbial motility

Appendices of the cell surface. Main motility mechanisms.

Unit 6. The life cycle of prokaryotes and forms of differentiation

Binary fission. Cellular division and control. Diversity in the cellular cycle in prokaryotes. Forms of differentiation. Endospores. Other

Unit 7. Microbial growth

Cellular growth and population growth. The main environmental factors affecting growth. Extrem environments.

Unit 8. Control of microbial growth by chemical agents.

Antimicrobial agents. Antiseptic, disinfectant, and chemotherapy agents. Antibiotics. Antimicrobial resistance.

Unit 9. The genome of prokaryotes and genetic transfer mechanisms

Characteristics of the genome of prokaryotes. Extrachromosomal genetic material: plasmids. Transposable elements. Mutagenesis. Mutations. Recombination. Genetic transfer mechanisms: Conjugation, transformation and transduction.

Unit 10. Metabolism: global scheme

Sources of energy, carbon and reducing power. Groups of microorganisms according to their nutrition. Metabolic diversity. Aerobic and anaerobic respiration. Chemolithotrophy. Fermentation. Oxygenic and anoxygenic photosynthesis.

Unit 11. Microorganisms in nutrient cycles

Microorganisms as agents of geochemical change: biochemical cycles. The carbon, nitrogen and sulfur cycles.

Unit 12. Microorganisms in their environment

Populations, communities and ecosystems. Microenvironment. Colonization of surfaces. Aquatic, terrestrial and aerial environments: diversity and the main characteristics. Trophic relationships between microorganisms. Positive interactions: commensalism, synergism and mutualism. Neutralism. Negative interactions: Competition, amensalism, predation and parasitism. Interactions with plants and animals.

Unit 13. Applied microbiology

Impact of microorganisms on human activities. Biotechnology. Industry. Environmental microbiology.

Laboratory practices content

Practice 1. Isolation, observation, characterization and identification of microorganisms.

Practice 2. Methods for determining microbial concentration.

Practice 3. Ubiquity and microbial diversity.

Methodology

The course comprises two modules: Theoretical lectures and practical laboratory classes. These are scheduled in an integrated way so that student must interact throughout the course content and the activities to achieve the competencies indicated previously in this guide.

Both modules are based on the following:

Theoretical lectures: The student must acquire the scientific knowledge of this subject attending these classes and help with the personal study of the topics explained. A detailed timetable of the topics, as well as the bibliography should be consulted to prepare theoretical classes and for the personal study of the theoretical content of the subject, will be delivered to the student at the beginning of the course.

Practical laboratory classes: At the beginning of the course the student will receive a Handbook with the practical work to be developed during the course. The objectives of these classes are: a) to facilitate the understanding of the knowledge presented in the theoretical lectures, b) to acquire manual skills, d) to interpret the results, and e) to integrate theoretical and practical knowledge.

These classes are sessions with a reduced number of students (22 as a maximum) and they include 5 sessions of 2 hours distributed as a session per day during the same week. The attendance to the practical classes is mandatory in order to acquire the competences of the subject. Student who cannot attend an individual or different sessions for justified and unforeseeable cause (as a health problem, death of a relative up to second degree, accident, enjoy the status of elite athlete and have a competition or sport activity of obligatory attendance, etc) shall be present, as soon as possible, official documentation to the responsible of the course (official medical certificate stating explicitly the inability to attend the session/s, police attestation, justification of the competent sports authority, etc.).

For attending the laboratory classes it is necessary the student to pass the biosafety and safety tests that will be find in the Moodle space and to know and accept the working rules of the laboratories of the Faculty of Biosciences. In addition, he must comply with the regulations of work in a laboratory of Microbiology that he will find indicated in the Handbook. At each lab session, it is compulsory for the students to wear their own lab coat, laboratory glasses, permanent marker, lighter, calculator, notebook and the Manual of the course, which will be available in the Moodle platform, or where teacher says.

Students will work in pairs and under the supervision of the teacher. At the beginning and / or during each session the teacher will make brief theoretical explanations of the practice content and procedures to be carried out by the students, as well as specific safety measures and the different chemical and biological generated waste treatment. In order to achieve a good performance laboratory of Microbiology that he will find indicated in the Handbook. In order to achieve a good performance and to acquire the competences corresponding to this activity it is essential that the student makes a comprehensive reading of the practices proposed before their completion. During each practice session, and whenever the teacher considers it necessary, it will do questions to students in reference to the previous reading of the Manual.

As supervised activities of the subject and in order to support the training activities mentioned above, a group tutorial in the theoretical class and individual tutorials can be carried out at the request of the students at the teachers' office Antoni Solé (C3-337), hours previously arranged by email.

The autonomous activities of this course are: study, text reading and the practice questionnaire preparation.

The student will have at the Moodle space all the documentation delivered by the teacher for the good monitoring of the subject. The student will also be able to consult the teaching space of the Degree Coordination to obtain updated information.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Practical laboratory classes	10	0.4	3, 2, 7, 5, 4, 6, 8, 9, 1, 11, 10

Theoretical lectures	15	0.6	3, 2, 7, 5, 4, 6, 8, 9, 1, 11, 10
Type: Supervised			
Tutorials	1	0.04	3, 2, 7, 5, 4, 6, 8, 9, 1, 11, 10
Type: Autonomous			
Practice questionnaire preparation	4	0.16	3, 2, 7, 5, 4, 6, 8, 9, 1, 11, 10
Study	30	1.2	3, 2, 7, 5, 4, 6, 8, 9, 1, 11
Text reading	9	0.36	3, 2, 5, 4, 6, 9, 11

Evaluation

The evaluation of the course will be individual and continuous through the following tests:

Assessment of the theoretical lectures module (70% of the overall mark): During the course two written tests of this module will be scheduled. These test are cumulative, this means that the second test will include all the thoretical contents of the subject, and the weighting of these test will be 28% and 42%, respectively. If the student does the two tests and obtains in the second one a higher mark than in the first one, the final mark of this module will be that of the second test. Each test will include three different parts: multiple choice questions (with a maximum of 6 points out of 10), true/false questions (with a maximum value of 2 out of 10), and short answer questions (with a maximum value of 2 out of 10).

In these classes it will be taken into account the punctuality and attitude of the student. This evaluation does not entail an increase of the note, but may mean the reduction of up to 25 % of the final grade obtained in this subject.

Assessment of the practice laboratory classes module (30% of the overall mark):

The attendance to the each practical session in this course is mandatory and the absence of any of the sessions must be justified to the responsible of the course before 48h after the date of the activity.

The evaluation of this module will consist of two test: a) Practical skill, which will consist of the delivery in pairs of a dossier about the different practical results obtained to the teacher in the last laboratory session and b) Questionnaire with multiple choice questions including 15 test questions about the work done in the laboratory and the results obtained and the resolution of an exercise. These tests will have a weight of 2 and 8 points, out of 10, respectively.

In these classes, the student's attitude in the laboratory, punctuality, the use of laboratory equipment (gown andgoggles), compliance with the safety and biosecurity regulations, and the understanding and follow-upof the Manual of the subject will be evaluated. This assessment does not entail an increase in the score, but it can mean the reduction of up to 20% of the final mark obtained in this module.

To pass the subject the student must obtain a score of 5 or higher in each module and in the final mark

. Students who do not pass any of the modules will be able to pass them on the date scheduled at the end of the semester for the second-chance examination. To be able to attend this exam it is necessary that the student has been previously evaluated of continous evaluation activities equivalent to 2/3 of the final mark. The re-assessment of the theory module will be done in a single written global test including multiple choice, true/fals and short questions. On the other hand the re-assessment of the practical laboratory classes module only the questionnaire with multiple choice questions indicated above will be done. In the case of obtaining a lower mark than 5 in one or more modules, the maximum final mark would be 4.

The students that cannot attend to an evaluation activity due to justified and unforeseeable cause (as a health problem, death of a relative up to second degree, accident, enjoy the status of elite athlete and have a competition or sport activity of obligatory attendance, etc) shall be present, as soon as possible and before 48h after the date of the activity, official documentation to the responsible of the course (official medical certificate

stating explicitly the inability to attend the session/s, police attestation, justification of the competent sports authority, etc.). In this case, the responsible of the course will decide if the student can do the evaluation in another date.

If the number of assessment activities carried out is less than 50%, the student will obtain the mark of Not Assessable.

Students wishing to improve the final mark of the course may present separately to an overall examination of the theoretical classes or another of the practical laboratory classes at the same data that the second-chance examinations. In this case, the presentation of the student in the overall examination involves the renunciation of the qualification previously obtained.

From the second registration of the subject on, students shall to pass the corresponding evaluation activities (theoretical and practical laboratory classes) to the current academic course, although it will not be necessary for the student to carry out the laboratory practices module if he / she has achieved the competences of this part of the subject in the previous course. This exemption will be maintained for a period of three additional registrations.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Practical laboratory classes assessment	Questionnaire	0.5	0.02	3, 2, 7, 5, 4, 6, 8, 9, 1, 11, 10
Practical laboratory classes: Dossier delivery	6	0	0	3, 2, 7, 5, 4, 6, 8, 9, 1, 11, 10
Practical laboratory classes: Questionnaire with multiple choice questions	24	1	0.04	3, 2, 7, 5, 4, 6, 8, 9, 1, 11, 10
Theoretical classes: Questionnaire with multiple choice questions	42	1.5	0.06	3, 2, 5, 4, 6, 8, 9, 1, 11
Theoretical classes: Questionnaire with short questions	14	0.75	0.03	3, 2, 5, 4, 6, 8, 9, 1, 11
Theoretical classes: Questionnaire with true/false questions	14	0.75	0.03	3, 2, 5, 4, 6, 8, 9, 1, 11
Theory assessment	Questionnaire	1.5	0.06	3, 2, 5, 4, 6, 8, 9, 1, 11

Bibliography

(in black the main bibliography)

Books

Madigan, MT., JM Martinko, K.S Bender, DH. Buckley, DA. Stahl. 2014. Brock Biology of microorganisms. 14th edition. Pearson, S.A. ISBN: 9780321897398.

Madigan, M., JM Martinko, KS Bender, DH. Buckley, DA. Stahl. 2015. Brock Biología de los Microorganismos. 14a edition. Pearson Educación, S.A. ISBN: 9788490352793.

Willey, J, LM Sherwood, CJ Woolverton. 2009. Microbiología de Prescott, Harley y Klein. 7ª ed. MacGraw-Hill-Interamericana de España. ISBN: 9788448168278.

Blogs

Esos pequeños bichitos <http://weblogs.madrimasd.org/microbiologia/>

Blog Small things considered <http://schaechter.asmblog.org/schaechter/>

Webs

<http://www.microbeworld.org/>

<http://weblogs.madrimasd.org/microbiologia/archive/2007/12/23/81281.aspx>

<http://microbewiki.kenyon.edu/index.php/MicrobeWiki>

<http://serc.carleton.edu/microbelife/>

<http://web.mst.edu/~microbio/Bio221.html>

<http://curiosidadesdelamicrobiologia.blogspot.com/>

<http://weblogs.madrimasd.org/microbiologia/>

<http://www.topix.com/science/microbiology>

<http://microbiologybytes.wordpress.com/>

<http://www.cellsalive.com/>

<http://commtechlab.msu.edu/sites/dlc-me/>

<http://commtechlab.msu.edu/sites/dlc-me/zoo/>

<http://www.microbiologia.com.ar/>