Universitat Autònoma de Barcelona

2019/2020

Microbiology

Code: 101025
ECTS Credits: 6

Degree	Type	Year	Semester
2500502 Microbiology	OB	1	2

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

Teachers

Nuria Gaju Ricart

Prerequisites

Although there are no official prerequisites, students are advised to review concepts that refer to the microbial world, previously studied.

Objectives and Contextualisation

It is a mandatory subject, nuclear in the degree of Microbiology that introduces students to the microbial world, giving an overview of the microorganisms, in connection with the rest of living beings and with the different environments in which they live.
This subject, given its introductory nature, offers the most basic concepts and competences referred to Microbiology, so that students can deepen in the following courses in other more specialized subjects of Microbiology.

Objectives of the subject:

1. To broadly recognize microbial diversity and to know how to distinguish the characteristics that define the different microbial groups.

2. To identify the different structures, as well as the composition of the prokaryotic cell.

3. To know the metabolic versatility of the different microbial groups, particularly that of prokaryotes.

4. To know the genomic variability of the microorganisms and the main mechanisms of exchange of genetic information in prokaryotes.

5. To recognize the main relationships of microorganisms with living organisms and with the physical environment they inhabit.

6. To know the role of microorganisms in the development of human societies, as well as their future applications.

7. To know how to perform basic calculations to determine microbiological parameters.

8. To understand and apply basic laboratory techniques to work experimentally with microorganisms.

Competences

- Apply knowledge of theory to practice
- Apply suitable methodologies to isolate, analyse, observe, cultivate, identify and conserve microorganisms.
- Communicate orally and in writing.
- Develop critical reasoning skills in the field of study and in relation to the social context.
- Display sensibility towards environmental, health and social matters.
- Identify and solve problems.
- Know and interpret microbial diversity, the physiology and metabolism of microorganisms and the genetic bases that govern their vital functions.
- Use bibliography or internet tools, specific to microbiology or other related disciplines, both in English and in the first language.
- Work individually or in groups, in multidisciplinary teams and in an international context.

Learning Outcomes

1. Apply knowledge of theory to practice
2. Communicate orally and in writing.
3. Describe cellular characteristics of microorganisms.
4. Describe microbial colonies.
5. Determine microbial concentration in several samples by using microscopy and seeding methods.
6. Develop critical reasoning skills in the field of study and in relation to the social context.
7. Discern the conventional microbiological techniques that allow differentiation between the various microbial groups.
8. Display sensibility towards environmental, health and social matters.
9. Evaluate the need for aseptic technique and manipulate materials and samples in aseptic conditions.
10. Identify and solve problems.
11. Identify metabolic diversity in microbes and relate it to the different groups of microorganisms.
12. Know microbial growth and the physical and chemical processes used to control it.
13. Know the genetic bases of microorganisms and their mechanisms of genetic transfer.
14. Prepare samples for staining and interpret microscope observations.
15. Prepare sterile material and culture media and identify their applications.
16. Recognise and consult microbial collections of model cultures.
17. Recognise the diversity of the microbial world and identify the different groups it is composed of.
18. Relate the basic microbial components and structures to their functions.
19. Solve basic calculus problems for microbial concentrations.
20. Use basic techniques for seeding and culturing microorganisms in different media and conditions.
21. Use bibliography or internet tools, specific to microbiology or other related disciplines, both in English and in the first language.
22. Work individually or in groups, in multidisciplinary teams and in an international context.

Content

THEORETICAL CONTENT (3.4 ECTS)

Unit 1. The microbial world. History and human societies and microorganisms. Discovering microorganisms. Levels of organization. Main differences between viruses and cellular organisms. Prokaryotic and eukaryotic organization. Groups and names of microorganisms.

Unit 2. Morphology, structure and chemical composition of viruses. Concept of virus. Morphology of viral particles: icosahedral, helical and complex symmetries. Structure of the viral envelope. The viral genome. Enzymes. Study methods.

Unit 3. Virus-host cell relationships. Viral cycle: one-step growth. Adsorption and penetration. Genome replication. Assembly and release of the virions. Possible effects of viral multiplication on the host.

Unit 4. Diversity of viruses. Criteria for Classification of Viruses (ICVT). Nomenclature. Classification of Baltimore. Prokaryotic and eukaryotic viruses. Other subcellular infectious agents.

Unit 5. The prokaryotic cell. Size and morphology. Nuclear region. Cytoplasmic membrane.

Unit 6. Prokaryotic cell layers, appendixes and mobility. Structure and function of the cell wall. Capsules or mucous layers. Appendixes. Main motility mechanisms.

Unit 7. Intracellular inclusions and forms of differentiation. Functional and reserve inclusions. Endospores Filaments and mycelia. Spores and cysts. Fruitful bodies.

Unit 8. The genome of prokaryotes. Structure of the genome. Size, topology and number of chromosomes. Extrachromosomal genetic material: plasmids. Transposable elements. Microbial genomics.

Unit 9. Mutagenesis. Spontaneous and induced mutations. Selection of mutants and phenotypic expression. The meaning of the DNA repair mechanisms.

Unit 10. Genetic transfer mechanisms. Transformation, transduction and conjugation.

Unit 11. The cell cycle of prokaryotes. Binary division. Cell division and control. Diversity of the prokaryotic cell cycle.

Unit 12. Microbial growth and continue culture of microorganisms. Cellular and populations growth. Environmental factors affecting growth. Basic concepts of continue culture.

Unit 13. Control of microbial growth by chemical agents.. Antimicrobial agents. Sterilizing, Antiseptic, disinfectant, and chemotherapy agents. Antimicrobial.

Unit 14. Metabolism: global scheme. Sources of energy, carbon and reducing power. Metabolic classes. Processes to obtain energy. Biosynthetic strategy.

Unit15. Chemolitotrophy. Inorganic energy donors. Inverse flow of electrons. Examples of chemolithotrophs.

Unit 16. Phototrophy. Anoxigenic and oxygenic photosynthesis. Pigments and organization of the phototrophic apparatus. Cyclic photophosphorylation. External donors of electrons.

Unit 17. Respiration. Respiratory chains. Aerobic respiration. Inorganic and organic compounds as final acceptors of electrons. Anaerobic respiration.

Unit 18. Fermentation. General characteristics of a fermentation process. Classification of fermentations. Examples.

Unit 19. Diversity of prokaryotes. The origin of life and biological diversification. Microbial systematics: taxonomy and phylogeny. Taxonomic ranges. Species concept in prokaryotes.

Unit 20. The archaea. Differential characteristics. *Phylum Euryarchaeota*: methanogens, extreme halophiles and hyperthermophiles. *Phylum Crenarchaeota*: hyperthermophiles and others.

Unit 21. Gram negative bacteria I. Taxonomic groups of proteobacteria. Differential features and examples.

Unit 22. Gram negative bacteria II. Taxonomic groups of other *phyla*other than *Proteobacteria*. Differential features and examples.

Unit 23. Gram-positive bacteria and mycoplasmas. *Firmicutes*, *Tenericutes* and *Actinobacteria*.

Unit 24. Microorganisms in their environment
Concept of microenvironment. Colonization of surfaces. Aerial, terrestrial and aquatic environments. Trophic relationships in microorganisms.

Unit 25. Biogeochemical cycles
Microorganisms as agents of geochemical change. Example: The nitrogen cycle.

PROBLEMS AND TECHNIQUES CONTENT (0.9 ECTS)

Session 1. Microscopic technique.
Session 2. Spread and isolation technique.
Session 3. Microscopic observations.
Session 4. Problems on basic microbiology.
Session 5. Problems on growth and microbial control.

LABORATORY PRACTICES CONTENT (1.7 ECTS)

Practice 1. Preparation of culture media, reagents and material for Microbiology.
Practice 2. Aseptic technique and methods of culture.
Practice 3. Methods for determining microbial concentration.
Practice 4. Isolation of microorganisms.
Practice 5. Microscopic technique.

Methodology

TEACHING METHODOLOGY AND TRAINING ACTIVITIES

The subject of Microbiology consists of three modules of supervised activities, which have been programmed in an integrated way so that the student must relate throughout the course the content and activities programmed to reach the skills indicated in this guide.

The three modules are as follows:

Participatory theoretical lectures: The student must acquire the scientific-technical knowledge of this subject by attending these classes and complementing them with the personal study of the topics explained. At the beginning of the course, the student will be given a detailed schedule of the topics to be discussed throughout the course, as well as the bibliography that should be consulted to prepare each theoretical class and for the personal study of the theoretical contents of the subject. The teaching of each subject will be based on a theoretical exposition.

Classes on methodology and problems: These classes are sessions with a reduced number of students with the aim of: a) working methodological aspects, b) facilitating the understanding of the knowledge presented in the theoretical lectures and c) bridging the theoretical lectures and practical laboratory work, with the objective of integrating theoretical and practical knowledge.At the beginning of the course the student will receive a detailed schedule of the contents of each session, which will indicate the bibliography to be consulted and the relationship of each session with the topics covered in the theoretical lectures and in the laboratory practices. A dossier will also be given with a proposal of problems that must be developed during the course. The sessions will be held in the classroom, where different methodological issues and basic microbiology problems will be discussed. Each student will explain the steps he has followed to solve the problems.

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 activities are: a) to facilitate the understanding of the knowledge presented in the theoretical lectures, b) to practice the experimental designs developed in the problem sessions, c) to acquire manual skills, d) to interpret the results, and e) to integrate theoretical and practical knowledge. The attendance to the practical classes is mandatory in order to acquire the competences of the subject. 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. 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.

As supervised activities of the subject, the students will be able to carry out tutorials in the teachers' office and / or through TICs. At the beginning of the course the procedure for conducting tutorials will be communicated.

The autonomous activities of this subject are: study, reading of texts and resolution of problems.

Additional information: For a good follow-up of the subject, the student will have in the Moodle space all the documentation indicated in the previous points.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory practices	15	0.6	1, 3, 4, 5, 7, 15, 14, 17, 18, 19, 22, 8, 20, 9
Lectures	30	1.2	12, 13, 3, 6, 10, 11, 17, 18, 21
Seminars and problems classes	5	0.2	12, 5, 7, 10, 15, 14, 16, 17, 19, 2, 22, 21
Vitual laboratory practices	3	0.12	1, 19, 22
Type: Supervised			
tutorials	4	0.16	1, 12, 13, 3, 4, 6, 5, 7, 10, 11, 15, 14, 16, 17, 18, 19, 2, 22, 21, 20, 9
Type: Autonomous			
Individual reading	17	0.68	6, 21
Individual study	50	2	12, 13, 3, 4, 5, 7, 10, 11, 15, 14, 16, 17, 18, 19, 22, 8, 21, 20, 9
Problems resolution	20	0.8	1, 5, 10, 19, 22

Assessment

The assessment of the subject will be individual and continuous through the following tests:

Module of evaluation of theoretical classes (60% of the overall mark). During the course two written tests of this module will be programmed, which are cumulative; i.e. the second test will include all the theoretical contents of the subject.

- The first test will have a weight of 24% and the second one of 36%.

- If the student does the two tests and obtains in the second one a higher mark than in the first one (provided that it is higher than 4.0), the final mark of this module will be that of the second test.

- Each test will include two or three short answer questions (with a maximum of 3 points out of 10) and a maximum of 60 multiple choice and / or true / false test questions (with a maximum value of 8 out of 10).

Module of evaluation of the classes on methodology and problems (20% of the overall mark). The evaluation of this activity will consist of the following tests:

A) Resolution of problems in the classroom

B) A written test at the end of the course that will consist of the resolution of a maximum of six problems and some test questions.

- These tests will have a weight of 3 and 7 points, out of 10, respectively. To pass this module you must obtain at least a 5 in the written test.

Module of assessment of the practical laboratory classes (20% of the overall mark). The evaluation of this activity will consist of two tests:

A) Practical skill, which will consist of the delivery of different practical results to the teacher during each laboratory session

B) Written test at the end ofthe practical laboratory classes consisting of a maximum of 20 test questions about the work done in the laboratory.

- These tests will have a weight of 4 and 6 points, out of 10, respectively. To pass this module the student must obtain at least 5 points in the written test.

To pass the subject the student must obtain a grade of 5 or higher in each module. Students who do not pass any of the written tests of the practical and methodology and problems modules will be able to retake them in the scheduled date for the assessment of the subject at the end of the semester. The re-assessment of the theory module will be done in a single written global test. Also on this same date, students wishing to improve their mark may present to an overall examination of the subject, which will include questions from all three modules. In this case, the presentation of the student in the re-assessment examination involves the renunciation of the qualification previously obtained.

To be eligible for the retake process, the student should have been previously evaluated in a set of activities equaling at least two thirds of the final score of the course or module. Thus, the student will be graded as "No Avaluable" if the weighthin of all conducted evaluation activities is less than 67% of the final score.

From the second registration of the subject on, 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.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Assessment of laboratory practices	20%	1	0.04	1, 3, 4, 5, 7, 15, 14, 17, 18, 19, 22, 8, 20, 9
Assessment of seminars and problems	20%	1	0.04	12, 5, 7, 10, 15, 14, 16, 17, 19, 2, 22, 21
Theory Assessment II	36%	2	0.08	12, 13, 6, 7, 10, 16, 18, 21
Theory assessment I	24%	2	0.08	12, 13, 3, 6, 10, 11, 17, 18, 21

Bibliography

Madigan, M.T., J.M. Martinko, K.S. Bender, D.H. Buckely, D.A. Stahl. 2015. Brock Biología de los Microorganismos. 14ª ed. Pearson Educación, S.A. ISBN:9788490352793.

Madigan, M.T., K.S. Bender, D.H. Buckely, W.M. Sattley, D.A. Stahl. 2018. Brock Biology of microorganisms. 15ª ed. Pearson, S.A. ISBN: 9780134261928.

Martín A., V. Béjar, J.C.Gutierrez, M. Llagostera, E. Quesada. 2019. Microbiología Esencial. 1ª edición. Editorial Médica Panamericana. ISBN: 9788498357868.

Willey J., L. Sherwood, C.J. Woolverton. 2017. Prescott's Microbiology, 10th ed. McGraw-Hill Education. ISBN: 9781259669934.

Blogs

MicroBio (https://microbioun.blogspot.com/)

Microbichitos (http://blogs.elpais.com/microbichitos/)

Esos pequeños bichitos (http://weblogs.madrimasd.org/microbiologia/)

Small Things Considered (http://schaechter.asmblog.org/schaechter/)

Curiosidades de la Microbiología (http://curiosidadesdelamicrobiologia.blogspot.com/)

Bacterias Actuaciencia (http://bacteriasactuaciencia.blogspot.com/)

El Rincón de Pasteur de Investigación y Ciencia (https://www.investigacionyciencia.es/blogs/medicina-y-biologia/43/posts)