Universitat Autònoma de Barcelona

2021/2022

Microbial Ecology

Code: 101020
ECTS Credits: 6

Degree	Type	Year	Semester
2500502 Microbiology	OB	2	2

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

Contact

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Use of Languages

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

Other comments on languages

Classes are held in catalan or spanish

Teachers

Maria Ramos Martínez Alonso

Prerequisites

Although no official prerequisite exists, students are advised to review the concepts that refer to the microbial world, studied previously. Also, it is advisable to have a good knowledge of the courses completed in the degree of Microbiology, as well as on other scourses done simultaneously during the second semester.

Objectives and Contextualisation

It is a mandatory course, nuclear of the degree of Microbiology, that introduces the student in the principles and terminology, as well as in the methods of study of Microbial Ecology. The objectives of the course are:

1. Acquire the basic concepts and methods of study of Microbial Ecology.

2. Display knowledge of the microorganisms in their natural habitats and the environmental factors that affect their distribution.

3. Recognize the main relationships established between microorganisms and other living organisms, such as plants and animals.

4. Understand the role of microorganisms in biogeochemical cycles.

Competences

- Apply suitable methodologies for taking samples and characterising and manipulating microbial populations and communities in natural and artificial ecosystems, and establish the relationships between these and those with other organisms.
- Communicate orally and in writing.
- 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 suitable sampling strategies and techniques for different types of environments.
2. Communicate orally and in writing.
3. Compare different types of extreme environments for life.
4. Describe the diversity of mechanisms by which microorganisms adapt to their environment.
5. Determine the role of microorganisms in symbiotic relationships.
6. Evaluate the role of microorganisms in biogeochemical cycles.
7. Identify and solve problems.
8. Interpret microbial diversity in accordance with the predominant environmental variables.
9. Understand the space-time dynamics of microorganisms in different habitats.
10. Use bibliography or internet tools, specific to microbiology or other related disciplines, both in English and in the first language.
11. Work individually or in groups, in multidisciplinary teams and in an international context.

Content

I. INTRODUCTION AND METHODS

1. Microbial Ecology: concept and historical development
Historical development. Microbial Ecology today. Concepts of Microbial Ecology.

2. Methods of study of Microbial Ecology (I)
Characteristics and objectives of the Microbial Ecology sampling. Sampling devices in different habitats. Preservation of samples.

3. Methods of study (II)
Quantification of microorganisms in the natural environment. Estimation of biomass. Estimation of microbial biodiversity with molecular techniques.

4. Methods of study (III)
Detection and measurement of microbial activity.

II. MICROORGANISMS IN THEIR NATURAL HABITATS

5. Microbial communities and abiotic factors
Microbial ecosystems: structure and dynamics. Environmental factors affecting the distribution of microorganisms. Extreme environments.

6. Microorganisms in their natural habitats: marine and freshwater environments
Introduction to natural environments. Water as a natural habitat. Lotic and lentic ecosystems. Coastal marine ecosystems. Open sea. Benthic environments of the deep sea.

7. Microorganisms in their natural habitats: terrestrial ecosystems
Soil composition and formation. Soil as a microbial habitat. The biosphere of the subsoil.

IIII. INTERACTIONS BETWEEN POPULATIONS

8. Interactions between microbial populations
Interactions within the same population. Transmission of chemical signals between microorganisms: quorum sensing. Neutralism. Positive interactions: commensalism, synergism and mutualism. Negative interactions: competition, amensalism, predation and parasitism.

9. Interactions between plants and microorganisms
Rhizosphere. Mycorrhizae. Fixation of nitrogen in the radical nodules. Philosphere.

10. Interactions between microorganisms and animals
Contribution of microorganisms to animal nutrition. Predation of animals by fungi. Other symbiotic relationships.

IV. BIOGEOCHEMICAL CYCLES

11. Microorganisms in nutrient cycles I
Carbon cycle: transfer of carbon through the trophic networks. Hydrogen cycle. Oxygen cycle.

12. Microorganisms in nutrient cycles II
Nitrogen, sulfur and phosphorus, iron and other elements cycles. Interrelations between cycles of different elements.

*Unless the requirements enforced by the health authorities demand a prioritization or reduction of these contents.

Methodology

The course of Microbial Ecology consists of two modules, which have been programmed in an integrated way so that the student will have to relate throughout the course the content and activities scheduled to reach the skills indicated in section 5 of this guide.

The two modules are:

Theoretical lectures. Within this module, master or expository lectures represent the main activity to be performed in the classroom and allow basic concepts to be transmitted to a large number of students in a relatively short time. They will be complemented with Powerpoint presentations and diverse didactic material that will be delivered to the students at the beginning of the course.

Seminars. They are group work sessions with a small number of students, based on work proposed by the teachers, that the students will work autonomously and will be discussed and exposed later in the classroom. Attendance at the seminar sessions is mandatory. In case of absence due to unjustified cause there will be a penalty in the seminar module note.

Additional Information:

In order to support the training activities mentioned above, individual tutorials can be carried out at the request of the students at the teachers' office Olga Sánchez (C3-335) and Maira Martínez-Alonso (C3-329).

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

*The proposed teaching methodology may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Seminars	12	0.48	1, 7, 2, 11, 10
Theoretical lectures	34	1.36	3, 9, 4, 5, 8, 2, 10, 6
Type: Supervised			
Individual/group tutorials	4	0.16	1, 3, 9, 4, 5, 7, 8, 2, 11, 10, 6
Type: Autonomous			
Bibliography search	15	0.6	10
Preparation of oral presentation	15	0.6	2, 11, 10
Study	35	1.4	1, 3, 9, 4, 5, 7, 8, 10, 6
Text reading	20	0.8	10
Work writing	10	0.4	2

Assessment

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

Assessment of the theoretical lectures module (65% of the overall grade): During the course two written exams of this module will be scheduled, the first exam will include topics 1 to 7 and the second exam topics 8 to 12. Each test will have a weight of 50% of the mark of the module and it will be necessary to obtain a score equal or superior to 5 to average them. Each exam will consist of multiple choice test questions, which will allow to assess a large part of the contents, and / or short answer questions aimed at assessing whether the key conceptual objectives have been achieved.

Assessment of the seminars module (35% of the overall grade): Different evaluative activities related to a scientific article will be carried out, which will include the following aspects:

1. Autonomous activities that are delivered through the Moodle space and in the work sessions in the classroom (10% of the overall grade).

2. Oral presentation of the work done (10% of the overall grade).

3. Written tests of oral presentations consisting of multiple choice test questions (15% of the overall grade).

Final considerations:

To pass the course the student must obtain a score of 5 or higher in each module. Students who do not pass any of the modules will be able to pass them on the date scheduled for the second-chance examination of the course, where the whole content of theory and / or the written test of seminars will be included. Autonomous deliveries, oral presentation and the written report can not be retaken.

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. Thus, the student will be graded as Non-evaluable if the weighing of all conducted evaluation activities is less than 67% of the final score.

The presentation of the student to raise the mark involves the renunciation to that obtained with the partial exams and he / she will have to perform the re-assessment of all contents of the course on the day scheduled for that purpose.

From the second course registration, those students repeating the course will not have to carry out the teaching activities, nor the assessment of those skills passed in the seminars module. That is, the mark obtained in the seminars module will be saved, as long as it has been passed.

*Student's assessment may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Seminars module assessment	35	2	0.08	1, 7, 2, 11, 10
Theoretical lectures module assessment 1	32,5	1.5	0.06	1, 3, 9, 4, 5, 8, 2, 6
Theoretical lectures module assessment 2	32,5	1.5	0.06	1, 3, 9, 4, 5, 8, 2, 6

Bibliography

Text books:

Atlas RM, Bartha R (2002). Ecología microbiana y microbiologia ambiental. 4ª ed., Pearson Educación SA.

Kirchman DL (2012). Processes in microbial ecology. Oxford University Press.

Madigan MT, Martinko JM, Bender KS, Buckley DH, Stahl DA. 2014. Brock Biología de los Microorganismos. 14ª ed. Pearson Education (http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=5850).

Madigan MT, Bender KS, Buckley DH, Sattley WM, Stahl DA. 2021. Brock Biology of Microorganisms. 16th ed. Pearson SA.

Martín A, Béjar V, Gutiérrez JC, Llagostera M, Quesada E. 2019. Microbiología Esencial. 1ª ed. Editorial Médica Panamericana (https://www.medicapanamericana.com/VisorEbookV2/Ebook/9788491102427#{%22Pagina%22:%22Portada%2

Willey J, Sherwood LM, Woolverton CJ. 2008. Microbiología de Prescott, Harley y Klein. 7ª ed. MacGraw-Hill (https://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=4148).

Willey JM, Sherwood LM, Woolverton CJ. 2017. Prescott's Microbiology. 10th ed. MacGraw-Hill.

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Software

No specific software is needed in this subject.