Universitat Autònoma de Barcelona

2022/2023

Microbial Ecology

Code: 100773
ECTS Credits: 6

Degree	Type	Year	Semester
2500250 Biology	OT	4	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: No
Some groups entirely in Spanish: No

Other comments on languages

Classes are held in catalan or spanish

Teachers

Olga Sanchez Martinez
Maria Ramos Martinez 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 courses 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

- Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
- Be able to analyse and synthesise
- Be able to organise and plan.
- Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
- Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
- Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
- Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
- Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
- Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
- Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
- Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
- Understand the processes that determine the functioning of living beings in each of their levels of organisation.

Learning Outcomes

1. Analyse a situation and identify its points for improvement.
2. Be able to analyse and synthesise.
3. Be able to organise and plan.
4. Critically analyse the principles, values and procedures that govern the exercise of the profession.
5. Identify the role of the different microbial groups in the environment and in the cycles of the elements, and their environmental implications.
6. Propose new methods or well-founded alternative solutions.
7. Propose viable projects and actions to boost social, economic and environmental benefits.
8. Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
9. Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
10. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
11. Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
12. Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
13. Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.

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 element cycles. Interrelations between cycles of different elements.

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).

Students 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.

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, 5, 6, 7, 12, 11, 10, 8, 9, 2, 3
Theoretical lectures	34	1.36	13, 4, 5, 12, 2
Type: Supervised			
Individual/group tutorials	4	0.16	5, 12, 8, 9, 2, 3
Type: Autonomous			
Bibliography search	15	0.6	12
Estudy	35	1.4	13, 4, 5, 12, 8, 9, 2, 3
Preparation of oral presentation	15	0.6	1, 5, 6, 7, 11, 10, 9, 2, 3
Text reading	20	0.8	13, 4, 12, 8, 9, 2
Work writing	10	0.4	13, 4, 1, 5, 6, 7, 10, 9, 2, 3

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 or module. 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.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Seminars module assessment	35	2	0.08	13, 4, 1, 5, 6, 7, 12, 11, 10, 8, 9, 2, 3
Theory assessment, part 1	32,5	1.5	0.06	5, 12, 11, 2
Theory assessment, part 2	32,5	1.5	0.06	5, 12, 11, 2

Bibliography

Text books:

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

Kirchman DL (2018). Processes in microbial ecology. 2nd ed. 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. 2020. Prescott's Microbiology. 11th ed. MacGraw-Hill.

In this link, it can be found an infographic prepared by the Library Service to facilitate the location of electronic books:
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Software

No specific software is needed in this subject.