Universitat Autònoma de Barcelona

2019/2020

Advanced Environmental Microbiology

Code: 42937
ECTS Credits: 9

Degree	Type	Year	Semester
4313775 Applied Microbiology	OB	0	2

Contact

Name: Olga Sánchez Martínez
Email: Olga.Sanchez@uab.cat

Use of Languages

Principal working language: spanish (spa)

Teachers

Nuria Gaju Ricart

Jordi Mas Gordi

Maria Ramos Martínez Alonso

Antonio Solé Cornellá

Prerequisites

Students are advised to carry out a review of basic microbiology concepts as well as aspects related to microbial ecology, environmental microbiology, and the use of molecular techniques in these disciplines.

Objectives and Contextualisation

In this module the student will be provided of theoretical and practical knowledge on advanced methodologies for the study of microorganisms in natural and artificial environments. The learning and understanding of these methodologies will allow him/her to acquire the necessary baggage for the use of microorganisms in the resolution of environmental problems.

Competences

- Apply the appropriate methodologies for sample collection, characterisation and analysis of microbial populations and communities.
- Design tools and strategies based on microorganisms to optimise industrial processes, assess the environmental impact of human activity and recover polluted environments.
- Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
- Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
- Use scientific terminology to account for research results and present these orally and in writing.

Learning Outcomes

1. Apply appropriate sampling strategies and techniques for microbial communities in natural and artificial ecosystems.

2. Characterise microorganism populations and communities from environmental samples.
3. Design bioremediation and biorecovery strategies based on microorganisms.
4. Know procedures and strategies based on microorganisms for pest and disease control.
5. Know the different bioindicators and bioassays based on microorganisms that help to assess environmental impacts.
6. Recognise microorganisms' role as causal agents of decay.
7. Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
8. Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
9. Use scientific terminology to account for research results and present these orally and in writing.

Content

1. Basic concepts of experimental design for the study of microbial communities

2. Analysis of biotope and biocenosis

3. Experimental laboratory models for the study of microbial communities

4. Optical and electron microscopy applied to environmental microbiology

5. Molecular microbial ecology

6. Analysis of the impact of human activity on natural environments

7. Environmental pollution and bioremediation

Methodology

The teaching methodology includes three types of activities, which have been programmed in an integrated way so that at the end the student acquires the skills indicated in this guide.

Theory block

Expositive theoretical lectures will be given where the basic contents of the module will be explained.

Specialized Seminars

There will also be seminars, given by experts in the different fields of environmental microbiology.

Block of practical classes

It includes:

Experimental laboratory practices: different sessions will be held on high resolution microscopy techniques, both optical and electronic, to determine changes in biodiversity and the uptake of metals by microorganisms in bioreparation processes of contaminated environments.

Classroom practices:There will be two sessions about experimental design for the collection of environmental samples and the characterization of the microbial diversity of different environments.

Computer practices: several sessions will be held in the computer room to introduce the student in the treatment and computer analysis of molecular data to study the diversity of microbial communities and the changes they experience in response to different environmental factors or human performances. The following aspects will be addressed:

1. Selection of primers by an *in silico* study to carry out a study ofmicrobial diversity of a given environment.

2. Statistical analysis of genetic profiles obtained through fingerprinting techniques.

3. Detection of diversity indexes based on the genetic profile of the microbial community.

4. Edition of sequences and determination of their phylogenetic affiliation.

Case studies: Different real or hypothetical environmental problems will be solved through a problem-based learning methodology. Students will address the cases raised, working in small groups, under the supervision of a tutor.

At the beginning, during the presentation of the module, teachers will present different case studies, the problems they entail, the guidelines of the work and the distribution of exposure sessions. During the work sessions the necessary tools for the development of the case studies will be provided.

Several tutorial sessions will be established to supervise the evolution of the case study approach by the group, where its members must deliver / expose to the tutor the work done. Such deliveries will be mandatory. However, the tutor will be available for additional consultations or tutorials when required by the students, in a previously set schedule.

Finally, each group will write a report / work on the causes of the problem and its resolution, and will make an oral presentation in class.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Experimental laboratory and computer practices	16	0.64	1, 7, 8, 9
Expert seminars	10	0.4	5, 8
Practical classes	21	0.84	5, 7, 9
Theoretical lectures	8	0.32	5, 8
Type: Supervised			
Tutorials of the case studies	12	0.48	1, 4, 7, 9
Type: Autonomous			
Preparation of case studies	40	1.6	1, 2, 5, 4, 3, 6, 9
Preparation of experimental and computer practices lab exercices	5	0.2	7, 8, 9
Preparation of oral presentations	25	1	7, 9
Search and management of information	30	1.2	9
Study	25	1	1, 5, 4, 7, 6, 9
Text reading	30	1.2	5, 4, 8, 9

Assessment

The specific and transversal skills will be evaluated through different activities:

1. Written test (40%): There will be a written examination of the content of the theoretical and practical classes, as well as the case studies. This exam will include short questions and / or test questions.

2. Assessment of the block of practical classes (20%). Laboratory / computer work and the resolution of the exercises raised during their accomplishment will be assessed.

3. Assessment of the case study (40%). The report will be evaluated (20%), as well as the oral defense of the case (20%).

Final considerations:

The case study is not eligible for the retake process. Students who do not pass any of the written tests from the theory and the block of practical classes will be able to retake them on the date scheduled for that purpose. 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.

In order to pass the module it is mandatory to attend all theoretical and practical classes, as well as oral defense sessions of case studies.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Assessment of case studies	40	0	0	2, 5, 4, 3, 7, 6, 8, 9
Assessment of practical classes	20	0	0	1, 9
Theoretical-practical assessment	40	3	0.12	5, 4, 7, 6, 9

Bibliography

It will be the student's responsibility to search and consult the bibliography necessary for the follow-up and completion of the module.

The teachers will give adequate advice to the students in this regard.