Functional Diversity of Microorganisms

Code: 100774
ECTS Credits: 6

<table>
<thead>
<tr>
<th>Degree</th>
<th>Type</th>
<th>Year</th>
<th>Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>2500250 Biology</td>
<td>OB</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

**Contact**

Name: Maria Ramos Martínez Alonso
Email: Maira.Martinez@uab.cat

**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: Yes

**Teachers**

Maria Teresa Llovet Pellejero
Neus Ferrer Miralles
Marc Llirós Dupré
José Luis Corchero Nieto

**Prerequisites**

Although no official prerequisite exists, students are advised to review concepts that refer to the microbial world, previously studied. Likewise, it is convenient to have a good knowledge of the courses previously studied in the degree of Biology.

In order to take this course it is necessary that the student has passed the tests of Safety and Biosafety that he/she will find in the corresponding Moodle space. It is necessary to present, the first day of class, the printed pdf documents generated when passing the tests. Also, it is necessary to know and accept the operating rules of the laboratories of the Faculty of Biosciences. In addition, it is imperative that the student follows the rules of work indicated by the teaching staff. For safety reasons, if the two tests have not been passed, or the student does not wear a lab coat and safety glasses, access to the lab will not be allowed.

**Objectives and Contextualisation**

This is a mandatory course of the third year of the Degree in Biology, which introduces students to the basic knowledge of prokaryotic and viral diversity, with special emphasis on their structural and ecophysiological characteristics, as well as their biotechnological importance, and in the need for constant updating of information through the bibliographic databases.

The main objective of the course is to provide the basic training for the study of the microbial diversity, physiology and metabolism of the main groups of prokaryotes and viruses.

The specific objectives of the course are the following:

- Recognize the diversity of prokaryotic microorganisms and virus
• Understand the principles of classical and molecular taxonomy.
• Know how to distinguish the characteristics that define the different taxonomic groups, their structural particularities, their ecophysiological characteristics and their importance.
• Learn how to apply the knowledge studied to carry out the identification and characterization of the main prokaryotic and viral groups.

Skills

• Be able to analyse and synthesise
• Be able to organise and plan.
• Describe and identify the levels of organisation of living beings.
• Develop critical thinking and reasoning and communicate ideas effectively, both in the mother tongue and in other languages.
• Develop independent learning strategies.
• Identify and classify living organisms.
• Isolate, culture and modify microorganisms and cells and tissues of multicellular organisms.
• Understand the processes that determine the functioning of living beings in each of their levels of organisation.
• Work in teams.

Learning outcomes

1. Apply the conventional microbiological techniques that allow differentiation between the various microbial groups.
2. Apply the methodologies needed to characterise and identify microorganisms in pure cultures and in complex samples.
3. Be able to analyse and synthesise.
4. Be able to organise and plan.
5. Develop critical thinking and reasoning and communicate ideas effectively, both in the mother tongue and in other languages.
6. Develop independent learning strategies.
7. Explain the role of microorganisms as agents of disease or toxicological problems in human beings, animals and plants.
8. Present the different groups of microorganisms, describe their differential characteristics and situate them phylogenetically.
9. Recognise the diversity of the microbial world and identify the different groups it is composed of.
10. Work in teams.

Content

Theory

Prokariotic Diversity

1. Introduction to prokaryotic diversity

What do we mean by prokayotic diversity? Phylogeny and implications in taxonomy. The concept of prokaryote.

2. Microbial systematics


3. Archaea domain
4. The deep-branching bacterial groups

Adaptations to life at high temperatures, and high radiation. Ecophysiological characteristics of the different groups and key genera.

5. Gram-Negative Bacteria I

Characteristics of the main groups of green phototrophic bacteria. General characteristics, ecological relevance and key genera. Main chemotrophic groups: Structure, classification and ecophysiology.

6. Gram-negative bacteria II


7. Gram-positive bacteria and mycoplasma

Morphological and ecophysiological characteristics, main phylogenetic groups and applied importance.

8. Groups of bacteria and archaea with few or not cultured species

Phylogenetic groups dominated by sequences of uncultivated organisms. Distribution and characterization. What do we know about the microbial world?

Viral diversity

9. Introduction: Virology and its origins


10. Virus nature and virological methodology


11. Virions: viral particles and their genomes


12. The viral cycle

13. Origin and evolution of viruses


14. Principles of viral taxonomy

First classifications of viruses: Baltimore classification of animal viruses. The International Committee of Virus Taxonomy and the classification system. Viral properties used in taxonomy.

15. Doubled-stranded RNA viruses


16. Single-stranded RNA viruses (1)


17. Single-stranded RNA Viruses (2)


18. Single-stranded DNA viruses


19. Double-stranded DNA viruses (1)


20. Double-stranded DNA viruses (2)


21. Double-stranded DNA viruses (3)


22. Hepadnavirus

23. Retroviruses


Problems / Seminars

1. Methods of isolation of microorganisms
2. Techniques of microscopic observation
3. Methods of identification and characterization of microorganisms
4. Work sessions with scientific articles

Laboratory work

1. Isolation of microorganisms from natural environments
2. Identification: biochemical and physiological tests
3. Preparation and quantification of viral lysates
4. Neutralization of viruses

Methodology

The course consists of three modules, which have been programmed in an integrated way so that the student will have to relate throughout the course the content and activities programmed in order to achieve the skills indicated in this guide.

Several learning strategies will be combined:

**Theory classes:** Student must acquire the scientific and technical knowledge of this course by attending these classes and complementing them with the autonomous study of the topics explained. At the beginning of the course, students will be given a detailed calendar of the topics that will be worked on throughout the course, as well as the bibliography that they will have to consult to prepare each theory class and for the autonomous study of the topics explained. Within this module, classes will be based on master or expository lectures and in a brief discussion of the same.

**Seminars/case resolution classes:** The purpose of these sessions is: a) working methodological aspects, b) facilitating the understanding of the knowledge presented in the theoretical classes, c) enable the student to design basic experiments id) make a bridge between the participatory theoretical classes and the practical work of the laboratory, with the aim of integrating the theoretical knowledge with the practitioners. The student will work on specific practical cases that will have to be developed during the course. In addition, the bibliography that will be consulted and the relation of each session with the subjects treated in the participative theoretical classes will also be indicated.

**Laboratory work:** The objectives of these activities are: a) facilitate the understanding of the knowledge exposed to the theory classes, b) apply the knowledge developed in the sessions of seminars/case resolution, c) acquire manual skills, d) interpret results and e) acquire the ability to work with microorganisms. Class attendance is compulsory in order to be able to acquire the skills of the course. In order to take this course it is necessary that the student has passed the tests of Safety and Biosafety that he/she will find in the corresponding Moodle space. It is mandatory to present, the first day of class, the printed pdf documents generated when passing the tests. Also, it is necessary to know and accept the operating rules of the laboratories of the Faculty of Biosciences. In addition, it is imperative that the student follows the rules of work.
indicated by the teaching staff. For safety reasons, if the two tests have not been passed, or the student does not wear a lab coat and safety glasses, access to the lab will not be allowed. Finally, in order to achieve good performance and acquire the competencies corresponding to this activity, it is essential that the student make a comprehensive reading of the proposed practices before their completion.

Additional information

In order to support the training activities indicated above, classroom tutoring sessions can be programmed at the request of the students. Likewise, the students will be able to carry out individual tutorials in the office of the professors Jose Luis Corchero Nieto (IBF-112.1) and Maira Martínez-Alonso (C3-329).

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

Activities

<table>
<thead>
<tr>
<th>Title</th>
<th>Hours</th>
<th>ECTS</th>
<th>Learning outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type: Directed</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laboratory work</td>
<td>12</td>
<td>0.48</td>
<td>2, 1</td>
</tr>
<tr>
<td>Seminar/case resolution classes</td>
<td>8</td>
<td>0.32</td>
<td>6, 5, 3, 4, 10</td>
</tr>
<tr>
<td>Theory lectures</td>
<td>31</td>
<td>1.24</td>
<td>8, 7, 9</td>
</tr>
<tr>
<td><strong>Type: Supervised</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individual/group tutorials</td>
<td>2</td>
<td>0.08</td>
<td>6, 5, 8, 7, 9, 3</td>
</tr>
<tr>
<td><strong>Type: Autonomous</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bibliography search</td>
<td>9</td>
<td>0.36</td>
<td>6, 5, 3, 10</td>
</tr>
<tr>
<td>Estudy</td>
<td>50</td>
<td>2</td>
<td>6, 5, 8, 7, 9, 3</td>
</tr>
<tr>
<td>Preparation and writing of works</td>
<td>20</td>
<td>0.8</td>
<td>6, 5, 8, 7, 9, 3, 10</td>
</tr>
<tr>
<td>Text reading</td>
<td>12</td>
<td>0.48</td>
<td>6, 5, 8, 7, 9, 3</td>
</tr>
</tbody>
</table>

Evaluation

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

**Assessment of the theory classes module (60% of the global mark):** During the course, two written exams of this module will be programmed. Each of the tests will have a weight of 50% of the module's mark, but the average will only be used if the test scores equal or superior to 5; otherwise, the student will have to carry out a second-chance examination of the failed written test. Each test will consist of short answer questions, aimed at assessing whether the key conceptual objectives have been achieved, and/or multiple choice test questions which will allow to evaluate a large part of the contents.

**Assessment of the seminar/case resolution classes module (20% of the overall mark):** The evaluation will include the following aspects:
Written test (10% of the overall mark).

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

Only the average will be made if the score of the tests is equal or superior to 5.

**Assessment of lab work module (20% of the global mark):** The evaluation will include the following aspects:

Completion of a questionnaire and monitoring of practical skills acquired which will consist of the delivery of different practical results to the teaching staff during the laboratory sessions (2% of the overall mark).

Oral presentation of the practical results (8% of the overall mark)

Written test (10% of the overall mark), which will consist of multiple choice test questions.

Only the average will be made if the mark of the tests is equal or superior to 5.

**Final Considerations:**

- To pass the course, you must obtain a score of 5 or superior in each module. Students who do not pass any of the modules will be able to reattempt them on the scheduled date for the final evaluation of the course.
- 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.
- Students who can not attend an individual assessment test for a justified cause and provide the corresponding documentation, will be entitled to take the test in question on another date.
- Students who wish to improve the grade will renounce to that previously obtained, and she/he will have to perform the re-assessment of all the contents corresponding to the different modules of the course on the day scheduled for that purpose.
- From the second enrollment, the repeating students will not have to carry out the activities, nor the evaluations of those skills surpassed, corresponding to the modules of seminars and practices. That is, the mark obtained in these modules will be saved, as long as they have been passed.

**Evaluation activities**

<table>
<thead>
<tr>
<th>Title</th>
<th>Weighting</th>
<th>Hours</th>
<th>ECTS</th>
<th>Learning outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory work assessment</td>
<td>20</td>
<td>1</td>
<td>0.04</td>
<td>2, 1</td>
</tr>
<tr>
<td>Seminar/case resolution assessment</td>
<td>20</td>
<td>1</td>
<td>0.04</td>
<td>6, 5, 3, 4, 10</td>
</tr>
<tr>
<td>Theory assessment I</td>
<td>30</td>
<td>2</td>
<td>0.08</td>
<td>8, 7, 9</td>
</tr>
<tr>
<td>Theory assessment II</td>
<td>30</td>
<td>2</td>
<td>0.08</td>
<td>8, 7, 9</td>
</tr>
</tbody>
</table>

**Bibliography**

**Recommended books:**


**Complementary books:**

- **The Prokaryotes.**


- Volume 1: The Prokaryotes: Prokaryotic Biology and Symbiotic Associations
- Volume 2: The Prokaryotes: Applied Bacteriology and Biotechnology
- Volume 3: The Prokaryotes: Prokaryotic Physiology and Biochemistry
- Volume 4: The Prokaryotes: Prokaryotic Communities and Ecophysiology
- Volume 5: The Prokaryotes: Medical Microbiology
- Volume 6: The Prokaryotes: Alphaproteobacteria and Betaproteobacteria
- Volume 7: The Prokaryotes: Firmicutes and Tenericutes
- Volume 8: The Prokaryotes: Actinobacteria
- Volume 9: The Prokaryotes: Gammaproteobacteria
- Volume 10: The Prokaryotes: Deltaproteobacteria and Epsilonproteobacteria
- Volume 11: The Prokaryotes: Other Major Lineages of Bacteria and the Archaea

- **Bergey's Manual® of Systematic Bacteriology**


**Volume package:**
