

Basics of Biology

Code: 106756
ECTS Credits: 6

2024/2025

Degree	Type	Year
2504604 Environmental Sciences	FB	1

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Teaching groups languages

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Prerequisites

Although there is no official prerequisite, students are advised to review the general concepts related to the microbial world, as well as the biochemistry and physiology of living beings, previously studied.

Objectives and Contextualisation

This is a compulsory, core subject of the Environmental Sciences degree, which introduces students to the world of Biology from various points of view (biochemical, physiological, and microbiological), taking into account the interrelationships between living beings and the environment in which they live.

Given its introductory nature, this subject gives the most basic concepts and skills related to Biochemistry, Physiology, and Microbiology, so that students can deepen in the following courses in other more specialized subjects from these areas.

The objectives of the subject are:

1. Recognize in general the biological diversity and know how to distinguish the characteristics that define the different groups of organisms.
2. Identify the different structures, as well as the composition of the prokaryotic and eukaryotic cells.
3. Distinguish the metabolic versatility of different organisms.

4. Recognize the genomic variability of microorganisms and the main mechanisms of exchange of genetic information in prokaryotes.
5. Recognize the main interrelationships between organisms and the physical environment they inhabit.
6. Determine the role of organisms in the development of human societies, as well as their future applications.
7. Perform basic calculations to determine biological parameters.
8. Distinguish and apply basic laboratory techniques to work experimentally with different organisms.

Learning Outcomes

1. CM22 (Competence) Work independently on the resolution of environmental problems and practical cases using basic biochemistry and microbiology concepts.
2. CM23 (Competence) Transmit the basic biological information associated with an environmental problem to members of the general public appropriately.
3. KM31 (Knowledge) Identify the main principles of biology involved in environmental processes.
4. KM32 (Knowledge) Identify the basic principles of biochemistry and microbiology.
5. KM33 (Knowledge) Recognise the structure and function of cells.
6. KM34 (Knowledge) Recognise the most relevant concepts, tools, parameters and biological cycles of organisms and micro-organisms, as well as their interaction with the environment, in order to analyse environmental problems.
7. SM28 (Skill) Collect, analyse and adequately measure both qualitative and quantitative data and observations in the field of biology.
8. SM29 (Skill) Safely use techniques, material and instruments for the biochemical and microbiological analysis of samples in the laboratory.

Content

Theoretical module

I. ELEMENTS AND BIOLOGICAL FUNCTIONS

Topic 1: Biomolecules. Organic compounds, proteins, lipids, carbohydrates, and their polymers, enzymes, and nucleic acids.

Topic 2: The cell as a structural and functional unit of living systems. Different types of cell organization: prokaryotes, eukaryotes, and differences between plant and animal cells. organelles. Cell cycle concept.

Topic 3: Water: properties and importance for living beings. Concept of water potential. Movement of water in the cell and through the tissues. Perspiration.

Topic 4: Mineral nutrition. Nutritional requirements and nutrient balance.

Topic 5: Energy transformation. Autotrophic/heterotrophic metabolism. Concept and functioning of photosynthesis and respiration. Primary and secondary metabolism.

Topic 6: Growth and development. Hormones and growth factors. Signal transduction mechanisms.

Topic 7: Interaction with the environment: regulation of development by light, temperature; relationship with other organisms.

II. MICROBIOLOGY

Topic 8. The world of microorganisms: Discovering microorganisms. Organization levels. Main differences between viruses and cellular organisms.

Topic 9. Structure and function of the prokaryotic cell: Size and morphology. Cytoplasmic membrane. Structure and function of the cell wall. capsules and mucous layers. the cytoplasm. the core region. Functional and reserve inclusions. Appendix. Main mechanisms of motility. Microbial taxis. Endospores.

Topic 10. The prokaryotic genome: Structure of the genome. plasmids. Transposable elements. Microbial genomics. Mutagenesis. Gene transfer mechanisms.

Topic 11. The cell cycle of prokaryotes: binary division. Cell division and control. Diversity of the cell cycle of prokaryotes.

Topic 12. Microbial growth. Influence of environmental factors on growth.

Topic 13. Control of microbial growth: chemical and physical methods. antimicrobial agents. Antimicrobial resistance.

Topic 14. Metabolism: global scheme: sources of energy, carbon, and reducing power. metabolic classes. Processes for obtaining energy. Biosynthetic strategy. Prokaryotic metabolic diversity.

Topic 15. Viruses: Morphology, structure and chemical composition of viruses. Study methods. Virus-host cell relations. Viral cycle. Virus diversity. Other subcellular infectious agents.

Topic 16. Diversity of prokaryotes: microbial systematics: taxonomy and phylogeny. Taxonomic ranks. The species concept in prokaryotes. The Archaea and Bacteria Domains.

Topic 17. Introduction to Microbial Ecology: concept and historical development. Methods of study in Microbial Ecology.

Topic 18. Microorganisms in their natural habitats: microbial communities and ecosystems. Marine environments and fresh water. Terrestrial ecosystems. Extreme environments.

Topic 19. Interactions between microorganisms and other living organisms: Interactions within the same population. Neutralism. positive interactions. negative interactions. Interactions between microorganisms and plants and microorganisms and animals.

Topic 20. Microorganisms as agents of geochemical change: Carbon cycle. The cycle of nitrogen, sulfur, and other elements. Interrelationships among cycles.

Laboratory work module

Biological elements and functions

1. Cytogenetic study in onion root tips (toxicity test).

Microbiology

1. Isolation, observation, characterization, and identification of microorganisms.
2. Microorganism count methods.
3. Ubiquity and microbial diversity.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
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Type: Directed			
Laboratory work	15	0.6	CM22, CM23, SM28, SM29
Theory lectures	38	1.52	CM22, KM31, KM32, KM33, KM34
Type: Supervised			
Individual/group tutorials	2	0.08	KM31, KM32, KM33, KM34
Type: Autonomous			
Bibliography search	15	0.6	CM22, KM31, KM32, KM33, KM34
Estudy	50	2	CM22, KM31, KM32, KM33, KM34
Preparation and writing of works	15	0.6	CM22, CM23, KM31, KM32, KM33, KM34
Text reading	10	0.4	KM31, KM32, KM33, KM34

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

The two modules are:

Participatory theoretical classes: The students must acquire 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, students will be given a detailed calendar of the topics that will be covered throughout the course, as well as the bibliography that they must consult to prepare for each theoretical class and personal study of the theoretical contents of the subject. The teaching of each topic will be based on a theoretical exposition.

Practical laboratory classes: At the beginning of the course, students will receive a Manual with the practical work they will have to do during the course. The objectives of these activities are: a) to facilitate the understanding of the knowledge exposed in the theoretical classes, b) to practice the experimental designs developed in the theory sessions, c) to acquire manual skills, d) to interpret results and e) to integrate theoretical with practical knowledge. Attendance in practical classes is mandatory to acquire the skills in the subject. To attend laboratory classes, students must have passed the biosafety and safety tests that they will find in the Moodle classroom, and they must know and accept the operating rules of the laboratories of the Faculty of Biosciences. In addition, they must comply with the work regulations in a Microbiology laboratory that they will find indicated in the Manual. To achieve good performance and acquire the skills corresponding to this activity, the students must make a comprehensive reading of the proposed practices before carrying them out.

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

The autonomous activities of this subject are study and reading of texts.

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

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.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Assessment of laboratory work	30	1	0.04	CM22, CM23, KM34, SM28, SM29
Theory assessment, part 1	26	2	0.08	KM31, KM32, KM33, KM34
Theory assessment, part 2	44	2	0.08	KM31, KM32, KM33, KM34

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

Module of evaluation of the theoretical classes (70% of the global mark). Throughout the course, there will be two written evaluation tests for this module, which are eliminatory.

The first test will have a weight of 26% and the second of 44% of the overall grade for the subject. Each test will include a maximum of 60 multiple-choice and/or true/false multiple-choice questions.

To pass this module, a minimum of 5 must be obtained in each written test.

Module of evaluation of the practical classes of laboratory (30% of global mark). The evaluation of this activity will consist of two tests:

- Practical ability, which will consist of delivering different practical results to the teaching staff during each laboratory session.
- Written test at the end of the practical laboratory classes that will consist of test questions and/or short 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, a minimum of 5 must be obtained in the written test.

To pass the subject, a grade of 5 or higher must be obtained in each module. Students who do not pass any of the written tests of the theory module and/or the written test of the practical module may have a second-chance exam on the scheduled date for the evaluation of the subject at the end of the semester.

To participate in the retake process, students must have been previously evaluated in a set of activities whose weight is equivalent to a minimum of two-thirds of the total grade for the subject or module. Therefore, the students will obtain the qualification of "Not Evaluable" when the evaluation activities carried out have a weighting of less than 67% in the final qualification.

Students who want to improve their grades may take a global exam on the subject, which will include questions from both modules. In this case, the presentation of the students to the improvement exam entails the resignation of the qualification previously obtained. The date of this exam will be the same as the second-chance exam date.

From the second course registration, it will not be necessary for the students to carry out the laboratory practice module if they achieved the skills of this part of the subject in the previous course. This exemption will be maintained for a period of three additional registrations.

Single evaluation

This subject considers the single assessment system that consists of a single summary test in which the contents of the entire theory program of the subject will be assessed. The test will consist of multiple-choice and/or true/false test-type questions, which will allow a large part of the contents to be assessed. The grade obtained in this synthesis test will account for 70% of the final grade for the subject and must be equal to or

greater than 5 to average with the practice module. The single assessment will be done on the same day as the second theory assessment (part 2) for the continuous evaluation of people.

The evaluation of the practical classes module will follow the same process as the continuous evaluation. The grade obtained will account for 30% of the final grade of the subject. The practical module is compulsory for all sessions. It is required to have passed it (grade of 5 or higher) to pass the subject.

Bibliography

Textbooks:

Cerezo García, M. 2015. Fundamentos de biología básica. Universitat Jaume I. Servei de Comunicació i Publicacions. <https://elibro.net/es/lc/uab/titulos/53274>. Electronic resource.

Cerezo García, M. 2018. Fundamentos de biología básica. 2ª ed. Universitat Jaume I. Servei de Comunicació i Publicacions.

Madigan MT, Martinko JM, Bender KS, Buckely DH, Stahl DA. 2015. Brock Biología de los Microorganismos. 14ª ed. Pearson Educación, S.A. ISBN: 9788490352793. Electronic resource.

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

Martín A, Bejar V, Guitiérrez JC, Llagostera M, Quesada E. 2018. Microbiología Esencial. Panamericana. ISBN: 9788498357868. Electronic resource.

Willey JM, Sherwood LM, Woolverton CJ. 2009. Microbiología de Prescott, Harley y Klein. 7ª ed. MacGraw-Hill Interamericana de España. ISBN: 978-84-481-6827-8. Electronic resource.

Willey JM, Sandman KM, Wood DH. 2023. Prescott's Microbiology, 12th ed. McGraw-Hill Education. ISBN:9781265123031.

Willey JM, Sandman KM. 2021. Prescott's Principles of Microbiology. 2nd ed. MacGraw-Hill. Electronic resource.

Blogs:

Esos pequeños bichitos

<http://weblogs.madrimasd.org/microbiologia/Blog>

Small things considered

<http://schaechter.asmblog.org/schaechter/>

Webs:

<http://www.microbeworld.org/>

<http://weblogs.madrimasd.org/microbiologia/archive/2007/12/23/81281.aspx>

<http://microbewiki.kenyon.edu/index.php/MicrobeWiki>

<http://serc.carleton.edu/microbelife/>

<http://web.mst.edu/~microbio/Bio221.html>

<http://curiosidadesdelamicrobiologia.blogspot.com/>

<http://weblogs.madrimasd.org/microbiologia/>

<http://www.topix.com/science/microbiology>

<http://microbiologybytes.wordpress.com/>

<http://www.cellsalive.com/>

<http://commtechlab.msu.edu/sites/dlc-me/>

<http://commtechlab.msu.edu/sites/dlc-me/zoo/>

<http://www.microbiologia.com.ar/>

Software

No specific software is needed in this subject.

Language list

Name	Group	Language	Semester	Turn
(PLAB) Practical laboratories	1	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	2	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	3	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	4	Catalan/Spanish	second semester	morning-mixed
(TE) Theory	1	Catalan/Spanish	second semester	afternoon