



IDENTIFYING DATA

Principles of marine microbiology

Subject	Principles of marine microbiology			
Code	V10G061V01208			
Study programme	(*)Grao en Ciencias do Mar			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	2nd	2nd
Teaching language	Spanish			
Department				
Coordinator	Longo González, Elisa			
Lecturers	Combarro Combarro, María del Pilar Longo González, Elisa			
E-mail	elongo@uvigo.es			
Web				
General description	Basic introduction to marine microorganisms and their place in the living world. We study the used methods in marine microbiology, especially those based on molecular biology . The subject explores the major metabolic pathways by which microbes obtain energy and carbon for cellular growth, with especial attention to physiology and diversity of bacteria and arqueas. Their role in diverse hábitats and in ocean processes are included			

Competencies

Code				
A2	Students can apply their knowledge and understanding in a manner that indicates a professional approach to their work or vocation, and have competences typically demonstrated through devising and sustaining arguments and solving problems within their field of study			
A3	Students have the ability to gather and interpret relevant data (usually within their field of study) to inform judgments that include reflection on relevant social, scientific or ethical issues			
A4	Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences			
B1	Know and use vocabulary, concepts, principles and theories related to oceanography and apply everything learned in a professional and/or research environment.			
B4	Manage, process and interpret the data and information obtained both in the field and in the laboratory.			
C9	Acquire basic knowledge about the structural and functional organization and the evolution of marine organisms.			
C10	Know the biological diversity and functioning of marine ecosystems.			
C11	Apply the knowledge and techniques acquired to the characterization and sustainable use of living resources and marine ecosystems.			
D1	Develop the search, analysis and synthesis of information skills oriented to the identification and resolution of problems.			
D2	Acquire the ability to learn autonomously, continuously and collaboratively, organizing and planning tasks over time.			
D5	Sustainability and environmental commitment. Equitable, responsible and efficient use of resources.			

Learning outcomes

Expected results from this subject	Training and Learning Results			
(*)Comprender o concepto de microorganismo, as súas características estruturais e a súa posición na escala biolóxica	A4	B1 B4	C9	D1
(*)Comprender e saber aplicar as diferentes técnicas de estudo da microbiota mariña	A2 A3	B4	C11	D1 D5
(*)Coñecer a diversidade da microbiota mariña e saber interpretar o seu papel nos ecosistemas mariños en relación á cadea trófica e ciclos dos elementos.	A4	B1	C10 C11	
New	A2 A3 A4	B1	C11	D2

Contents	
Topic	
Lesson 1. Microorganisms on the marine ambient	1.1. Purpose and field of study of marine microbiology 1.2. Microorganisms on the biological scale. 1.3. Role of microbiota in marine ecosystems. 1.4. Perspectives of marine microbiology
Lesson 2. Structure and function of prokaryotic microorganisms and acellular agents	2.1. Structure and function of prokaryotic microorganisms 2.2. Structure and function of acellular agents
Lesson 3. Microbial physiology	3.1. Microbial growth in the laboratory: mathematical expression 3.2. Microbial growth in the marine environment: effect of environmental factors 3.3. Cooperative and multicellular processes 3.4. Asexual reproduction in bacteria
Lesson 4.- Methods of study of marine microbiota: culture-dependent techniques	4.1. Concepts of asepsis and sterilisation 4.2. Sampling techniques. 4.3. Isolation, cultivation and conservation techniques .4.4. Techniques of cuantification. 4.5. Techniques for the characterisation of pure cultures.
Lesson 5.- Methods of study of marine microbiota: non-cultivation dependent techniques	5.1. U.V. light microscopy: unespecific fluorescence . 5.2. Flow Cytometry 5.3. In Situ Hybridization Techniques 5.4. Selective Amplification and sequencing: PCR; DGGE; NGS sequencing techniques 5.5. Principles of Metagenomic Analysis
Lessons 6. Diversity of marine microbiota.	6.1. Relevant species in the Bacteria, Archaea and Eucarya domains. Position in the phylogenetic tree. 6.2. Microorganisms in the trophic chain. 6.3. Microorganisms in the element cycles 6.4 Symbiotic associations with animals and plants 6.5. Diversity of Viruses and Bacteriophages Role in marine microbial ecosystems
LABORATORY PRACTICAL	1. Preparation of culture media 2. Sampling of environmental samples 3. Isolation and preservation of pure cultures 4. Cuantification of microorganisms 5. Tests of bacterial identification.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	29	26	55
Laboratory practical	17.8	9	26.8
Collaborative Learning	1.8	0	1.8
Seminars	1.9	0	1.9
Essay questions exam	0.15	20	20.15
Objective questions exam	0.75	27	27.75
Problem and/or exercise solving	0.1	12	12.1
Objective questions exam	0.2	4	4.2
Objective questions exam	0.2	0	0.2
Essay	0.1	0	0.1

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies	
	Description
Lecturing	The teacher structures and/or explains the objectives and contents of each topic and responds to the questions posed by the students. At final for each topic, the students will have at their disposal at Fatic the presentations discussed in the classroom, demonstration videos and links to free access texts. During the semester the teacher will evaluate the students by means of five tests of a maximum of 20 minutes each, with developmental and objective questions and exercises. Any tests that are missed or not taken may be made up in the exam final of the first and/or second call.
Laboratory practical	The teacher explains the fundamentals and protocols of the practice, supervises its execution and solves the doubts of the students. The students will have a Practice Guide with the protocols and fundamentals of each practice. The teacher will evaluate the students at the end to the week by means of a single test of objective questions, which, in case of failure, can be recovered in the final exam of the first and/or second call.
Collaborative Learning	The teacher organizes, advises and supervises the integrated collaborative learning activities to be developed in groups of three or four students and examines the contents worked on through a test of objective questions.
Seminars	The students, organized in groups, will make a work to the computer that they will have to deliver at the end of the seminar for its evaluation. The teacher explains the procedure to follow and advises on the development of the work. The work will be handed in at the end of the seminar and will be used by grade the student.

Personalized assistance

Methodologies	Description
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Laboratory practical	The students will be able to solve doubts with the teacher, during the practices or once finished, making an appointment by e-mail within their tutorial schedule
Seminars	The students will be able to solve doubts with the professor during the development of the seminar.
Lecturing	The students can solve doubts with the teacher, during the classes or out of them, making an appointment by e-mail within their tutorial schedule
Collaborative Learning	The students will be able to solve doubts with the professor during the development of the seminar.

Assessment

	Description	Qualification	Training and Learning Results		
Essay questions exam	MASTER CLASS. The contents exposed in the classroom will be evaluated with five partial tests of eliminatory character, with the same relative weight in the final mark of the student. 10% of the student's final mark will come from development questions included in these tests.	10	A2 A3 A4	C9 C10	D5
Objective questions exam	MASTER CLASS. 35% of the student's final mark will come from the objective questions that are part of the five partial tests mentioned above.	35	A2 A3 A4	C9 C10	D5
Problem and/or exercise solving	MASTER CLASS. 10% of the student's final marks will come from the resolution of exercises and problems included in one of these partial tests.	10	A2	B4	
Objective questions exam	LABORATORY PRACTICAL. The contents worked on in practical classes will be evaluated by means of a test of objective questions, which will take place on the last day of the week.	33			
Objective questions exam	SEMINAR I. Collaborative Learning. The contents worked on will be evaluated in the last part of the seminar by means of a single test of objective questions.	6	A2	B1	D1 D2
Essay	SEMINAR II. The contents worked on will be evaluated through group work, to be carried out during the seminar.	6	A3 A4		D2

Other comments on the Evaluation

- In order to pass the course, the students will have to :

1) Attend Seminars and Laboratory Practice. One time only attendance is allowed, justify an absense.
2) Pass, with at least 5 points out of 10, each of the five partial tests (four of Theory and one of Practice) taken during the semester. If this is not the case, only the failed partial tests can be recovered in the exam final (first and/or second call), keeping the grades of those passed during the semester. If the minimum mark is not reached in any of the partial exams, the calificación in certificate will always be the average mark of the failed exams.

- Any student has the right to take the full course only in the exam final. Students who pass the six partial tests of the semester may expressly waive the calificación obtained, if they wish to take the final exam of the complete subject, in order to improve their grade.

- Those students who have failed any of the partial tests of the semester and do not take the final exam (June and/or July) will be considered as "Not Submitted". Likewise, students who, having waived their grades during the semester, do not take the final exam (June and/or July) to improve their grades will be listed as calificados with No Submission.

- In the event of not passing the subject in the second call (July), the student will have to take the failed part (practice or FULL theory) in the following oficial calls.

□Students are strongly requested to fulfil a honest and responsible behaviour. It is considered completely unacceptable any alteration or fraud (i.e., copy or plagiarism) contributing to modify the level of knowledge and abilities acquired in exams, evaluations, reports or any kind of teacher's proposed work. Fraudulent behaviour may cause failing the course for a whole academic year. An internal dossier of these activities will be built and, when reoffending, the university rectorate will be asked to open a disciplinary record□

Sources of information

Basic Bibliography

Josep M. Gasol J.M., David L. Kirchman, **Microbial Ecology of the Oceans**, 3th ed, Wiley Blackwell, 2.18

MUNN, C.B., **Marine Microbiology : Ecology and Applications**, 2nd ed., Garland science, 2011

Madigan, M.T. , K. S. Bender, D. H. Buckley, W.M. Sattley, D. A. Stahl., **Brock Biology of Microorganisms**, 16th ed., Pearson Education, 2020

Complementary Bibliography

Madigan, M. Martinko, J. M., Bender,K. y otros, **Brock Biology of Microorganisms**, 14th ed, Pearson Education, 2015

Willey, J.M., Sherwood, L. M. & otros, **Prescott Microbiology.**, 10 th ed., Mcgraw-Hill Education, 2017

Recommendations

Subjects that continue the syllabus

Marine microbiology and parasitology/V10G060V01906

Subjects that it is recommended to have taken before

Biology: Biology I/V10G061V01101

Biology: Biology 2/V10G061V01106

Contingency plan

Description

MIXED TEACHING MODALITY

- MODIFICATIONS IN THEORY LESSONS: a) The lectures will be given synchronously in the classroom and in the Remote Campus. The Deanship will distribute the students into two groups, which will follow the classes in one or the other modality, respectively. b) The program of contents will be maintained, but the depth of the topics will be reduced if the rhythm of progress is altered by incidents of a technical nature. c) The evaluation tests will take place online, from Faitic (or Moodle) and Remote Campus, simultaneously.

2. MODIFICATIONS IN PRACTICAL AND SEMINARS: the both activities will be face-to-face. There are no modifications on seminars. In Laboratory Practical the following are established: a) Part of the contents will be treated by means of virtual laboratory videos. b) The students will dedicate part of the daily time of the practical to the disinfection of their work stations and the equipment and utensils they have used.

3. OTHER COMMENTS ON THE EVALUATION: The description in the section of the same name in this Teaching Guide is maintained (Step 7).

4. MODIFICATIONS IN TUTORIALS: during tutorial hours, students may use e-mail to express doubts about theoretical or practical classes. The attention to the students is reinforced by enabling the Faitic Forum (or Moodle).

ON LINE TEACHING MODALITY

1. MODIFICATIONS IN THEORY CLASSES: the exhibition sessions will take place in Remote Campus for the total number of students.

2. MODIFICATIONS IN PRACTICES AND SEMINARS: the practical classes will be given from the Remote Campus, by means of presentations by the professor, demonstrative videos and resolution of questionnaires, exercises and practical cases. With respect to the Seminars, the Collaborative Learning sessions described in this Teaching Guide (Step 5) will be replaced by the preparation of individual or group deliverables.

3. OTHER COMMENTS ON EVALUATION: what is described in the section of the same name in this Teaching Guide (Step 7) is maintained, with a modification: the minimum mark required in the tests, both theory and practice, in order to add up the percentage marks will be 4 points out of 10.

4. SOURCES OF INFORMATION: the students will have at their disposal in Faitic the resources mentioned in this Teaching Guide (steps 5 and 8), in addition to all the didactic material used in the non-presential classes of the Practices.

5. MODIFICATIONS IN TUTORIALS: during tutorial hours, students may use e-mail to express doubts about theoretical or practical classes. The attention to the students is reinforced by enabling the Faitic Forum (or Moodle).
