COURSE DATA

Data Subject	
Code	33168
Name	Microbiology
Cycle	Grade
ECTS Credits	6.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1102 - Degree in Biotechnology	Faculty of Biological Sciences	2	Second term

Subject-matter

Degree	Subject-matter	Character
1102 - Degree in Biotechnology	81 - Foundations of functional biology	Obligatory

Coordination

Name	Department
ESTEVE SANCHEZ, CONSUELO	275 - Microbiology and Ecology

SUMMARY

Microbiology is part of the Degree in Biotechnology, University of Valencia (2009 Plan). It is a compulsory, 6 -credit subject pertaining to Fundamentals of Functional Biology, along with Genetics, Animal Biology and Plant Biology. The first two are studied in the first term and Microbiology corresponds to the second semester along with Plant Biology. It has been preceded by the compulsory subjects Biological Diversity (1), Cell Biology (2nd year, first semester), and Methods in Biochemistry and Molecular Biology (2nd year, annual), in which the student develops and assimilates knowledge that is a basis for Microbiology. The course, therefore, will not develop basic aspects, since they are previously acquired. Also, we avoid the recurrence with concepts acquired with Introduction to Biochemical Engineering and Plant Biology, subjects coursed in parallel.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

- Eukaryotic cell biology.
- General aspects of Biochemistry and Molecular Biology, with particular attention to metabolism and regulation.

COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

1102 - Degree in Biotechnology

- Aprender a trabajar de forma adecuada en un laboratorio con material biológico (microorganismos, plantas y animales) incluyendo seguridad, manipulación y eliminación de residuos biológicos, y con registro anotado de actividades.
- Manejar cultivos de microorganismos en medio sólido y líquido y realizar pruebas bioquímicas básicas.
- Learn, develop and apply the main techniques for the preparation, staining and observation of biological samples.
- Be able to observe and interpret the results obtained through optical microscopes.
- Be able to place the different living beings in the phylogenetic tree.
- Ser capaz de identificar organismos eucarióticos y procarióticos a nivel de género y/o especie.
- Be able to understand the evolutionary relationships between organisms.
- Saber predecir las consecuencias de la actividad humana sobre la biodiversidad y el medio ambiente.

LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

English version is not available

DESCRIPTION OF CONTENTS

1. Introduction

The concept of Microbiology. Historical development and nature of the microbial world.

2. Prokaryotic structure and function

Cellular morphology and size. Cytoplasmic membrane in Archaea and Bacteria. Membrane functions. Bacterial cell Wall. Murein or peptidoglycan. Differences between Gram-negative and Gram-positive bacteria. Mycobacterial cell Wall. Archaea cell walls.
Bacterial flagella. Spirochaetal motility. Archaeal flagella. Gliding motility. Tactisms. Magnetosomes, gas vacuoles. Adhesión structures: capsules and fimbria. Biofilms. Cell storage inclusions.
Unicellular bacteria: cell división. Filamentous bacteria. Alternating cell stages: bacterial endospores. Other life cycles.

3. Microbial growth. Physico-chemical factors influencing microbial growth

Growth of microbial populations: parameters. The batch culture curve: phases and parameters. Continuous culture. Temperature. Water activity. pH. Oxygen. Hydrostatic pressure. Radiation. Organic and inorganic growth inhibitors. Desinfectants and antiseptics. Sterilization and control.

4. Nutrition and metabolism

Principles of microbial nutrition and metabolism. Microbial metabolisms: energy, reducing power and precursor metabolites. Nutritional types.
Types of microbial phototrophs. Pigments. Anoxygenic photosynthesis. Oxygenic photosynthesis. Bacteriorhodopsin system.
Types of microbial chemotrophs. Redox potential. Aerobic and anaerobic respiration. Chemolitotrophy. Heterotrophic catabolism. Fermentation.
Carbon assimilation by microbial autotrophs. Nitrogen assimilation from nitrate and from N2.

5. Microbial genomes and its evolution

Types of genetic elements in the eukaryotic and prokaryotic cell. Genomics of microorganisms. Mutation and recombination. Horizontal transfer of genetic information in Prokaryotes. MMR system. Cas/CRIPR system. Concept of pan-genome and essential genome. Regulation of gene expression in prokaryotes: strict response; catabolite repression; quorum sensing.

6. The Virus

Definition. Composition, structure and Types. Classification. Viral detection and quantification. General features of viral growth. Bacteriophages: virulent and temperate phages. Animal and vegetal viruses. Viroids, prions. Antiviral drugs.

7. Microbial biodiversity

Main structural and functional characteristics of Bacteria, Archaea and Eukarya. Microbial systematics, taxonomy and nomenclature. Taxonomic categories and species concept in Microbiology.
Generalities of the Bacteria domain. General characteristics of the main Phyla and their genera/species of biotechnological interest.
Overview of the Archaea domain. General characteristics of the main Phyla and their genera/species of biotechnological interest.
Phylogenetic tree of the Eukarya domain. Main groups of protists and their main genera. Fungi: general characteristics and groups of biotechnological interest.

8. Human microbiome and disease

Human microbiome and dysbiosis. Bacterial pathogenesis. Chemotherapeutic agents: antibiotics and synthetic chemotherapeutics. Antibiotic resistance.

9. Practice

- The principles of safety and good practice at the microbial lab. Sterilization methods.
- Microbial handling and transfer techniques.
- Nutrition and culturing microorganisms: types of culture media. Culturing bacteria and fungi. Differential and selective media.
- Isolation of pure microbial cultures.
- Ligth microscopy of microbes: differential staining techniques (Gram, endospore staining).
- Counting microrganisms: total and viable counts (plate count of bacteria and phages, membrane counts).
- Detecting microbial activities: extracelular enzymes, oxidation/fermentation of carbohydrates, fermentative paths.
- Antimicrobial sensitivity: antibiogram.
- Identification through miniaturized tests and numerical profiling.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	38,00	100
Laboratory practices	20,00	100
Tutorials	2,00	100
Development of individual work	5,00	0
Study and independent work	30,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	40,00	0
Preparation of practical classes and problem	10,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

Lectures: thirty-eigth lectures given by the professor on fundamental aspects of the theory syllabus. Assistance is optional. Students will be provided in advance with the recommended specific literature and images to be used for the presentations ("Aula Virtual") .

Tutorial group: two group tutorials in which model questionnaires (previously available to the students through "Aula Virtual") are discussed and solved. The tests refer to content already developed in lectures. Attendance is mandatory.

Laboratory: The lab sessions are developed intensively for two weeks. These classes are compulsory and they are supported by a booklet of practice (available through "Aula Virtual") with the protocols and a brief description.

Additional optional activities include reading scientific texts (articles, reviews), informed commentary on news in the field of Microbiology in the media, commented conferences and seminars on the subject and any other activity that, in agreement with professor, serve to supplement the student's education or microbiological illustrates the development of skills provided in the Teaching Guide.

EVALUATION

It is considered fundamental for the evaluation of the learning carried out by the student the direct verification of their level through the tutorials carried out throughout the course and the relationship established with the teacher in the laboratory, this level of relationship being one of the most informative and efficient. All this will allow the teacher to directly establish a dynamic image of the evolution throughout the course of each student, provided that the maximum number of students per group and subgroups of practices is respected. The numerical qualification of the knowledge and skills acquired will have to be established, however, using methods that allow a comparable and objective measurement of the same, with a record of results, which implies the qualification of written tests and the preparation of assignments.

To pass the evaluation, you need to have obtained a minimum of 5 points out of 10, with the following distribution: THEORY: 7.0 out of 10.

- Attendance at the classes: Optional
- Attendance at group tutorials: required
- Final exam: up 7.0 points (3.5 points minimum required).

The evaluation will be done on the basis of a written exam in the official calls: first round (june) and second one (july).

PRACTICES: 2.5 out of 10.

- Attendance to the lab sessions is mandatory.
- Practice Exam: up 2.5 points (minimum 1.25 points).

The evaluation of this part will be based on a written exam in the official calls. The attendance to lab sessions is mandatory and the student must have completed them in order to request an advance notice.

OTHER ACTIVITIES: 0.5 out of 10. No minimum or mandatory.

The highest score cannot be reached if the student does not involve in other activities, since in that case the maximum achievable score would be 9.5 out of 10.

After passing each of the parties listed above the marks obtained will be kept until the second call if any of the other parts were not surpassed in the first call. There will, therefore, an examination of theory and practical examination in the second call, whose qualifications rating will add, once they are both passed independently.

Second enrollment students who have passed the course practices can conserve their practical examination marks only for the next immediately following course.

REFERENCES

Basic

- MADIGAN, M.T., J.M MARTINKO, P.V. DUNLAP & D.P. CLARK. 2009. Brock- Biología de los Microorganismos. 14ª ed. Pearson. Adison Wesley.
  La asignatura comprende los contenidos que se desarrollan en las Unidades 1-6 y 9, cuyo conocimiento se considera esencial para superar la asignatura.
- WILLEY, J.M., L.M. SHERWOOD & C.J. WOOLVERTON. 2009. Microbiología de Prescott, Harley y Klein. 9ª ed. McGraw-Hill-INTERAMERICANA DE ESPAÑA, S.A.U.
  La asignatura comprende los contenidos que el libro desarrolla en las Partes I (T1 y T3), II (T5-T7), III (T9 y T10), IV (T12 y T13), VI (T16-T18), VII (T19-T24), VIII (T27 y T30), X (T33 y T34) y XI (T40 y T41).

Additional

- SCHAECHTER, M., J. L. INGRAHAM & F. C. NEIDHARDT. 2006. Microbe. 1st ed. ASM Press. Washington DC.
- BARTON, L.L. 2005. Structural and functional relationships in prokaryotes. Springer. New York.
- DWORKIN, W. (Editor in Chief). 2006. The Prokaryotes. A handbok on the Biology of Bacteria. 3nd ed. Vol. I - VII. Springer.
- SINGLETON, P. & D. SAINSBURY. 2001. Dictionary of Microbiology and Molecular Biology. 3rd ed. Wiley.
- SLONCZEWSKI, J.L. & J.W. FOSTER. Microbiology, an Evolving Science. 2009. W.W. Norton. New York. London.
- REDDY, C.A. (Ed. in chief). Methods for General and Molecular Microbiology. 2007. ASM Press. Washington DC.