

MICROBIOLOGY

MODULE	CONTENT	YEAR	TERM	CREDITS	TYPE
Basic Formation	Microbiology	2 nd	1 st	6	Basic
LECTURER(S)	Postal address, telephone n°, e-mail address Dept of Microbiology, 4 th floor, School of Pharmacy and Laboratory of Microbiology. CIBM Victoria Béjar: 958 241754 and 958249935 (vbejar@ugr.es) Inmaculada Sampedro: 958249935 (isampedro@ugr.es)				
TUTORING HOURS	Victoria Béjar 1 st term: Tuesday 10.30-13.30, Wednesday 10.30-13.30; 2 nd term: Tuesday 11.30 – 13.30; Thursday 11.30-13.30 and Friday 10.30 – 12.30 Inmaculada Sampedro Tuesday 11.30-14.30, Thursday 11.30-14.30				
DEGREE WITHIN WHICH THE SUBJECT IS TAUGHT	Degree in Science and Food Technology				
PREREQUISITES and/or RECOMMENDATIONS (if necessary)					
It is recommended to have studied the subjects Biology, Structural Biochemistry and Chemistry					
BRIEF ACCOUNT OF THE SUBJECT PROGRAMME					
Structure and diversity of microorganisms. Nutrition and metabolism, genetics and microbial physiology. Methods of observation, culture and conservation of microorganisms. Pathogenicity and control of microorganisms.					
GENERAL AND PARTICULAR ABILITIES					
A. General competences: CG1: Ability to express oneself correctly in its disciplinary field; CG2: Problem solving; CG3: Team work; CG4: Ability to apply theoretical knowledge to practice; CG7: Capacity for analysis and					



synthesis; CG8: Clinical reasoning; CG9: Motivation for quality.

B. Specific competences:

CE1: Recognize and apply the physical, chemical, biochemical, biological, physiological, mathematical and statistical fundamentals necessary for the understanding and development of food science and technology.

OBJECTIVES (EXPRESSED IN TERMS OF EXPECTED RESULTS OF THE TEACHING PROGRAMME)

Acquire knowledge of the microbial world from any perspective to understand the biosphere, with a preferential orientation to the multidisciplinary activity of food technology.
Manage the basic techniques of Microbiology.

DETAILED SUBJECT SYLLABUS

THEORETICAL SUBJECT

THEMATIC SECTION I. INTRODUCTION TO MICROBIOLOGY

Topic 1. Concept and historical development of Microbiology. 1. Microbiology, microorganisms and their types. 2. Microbiological methods and the discovery of microorganisms. 3. The golden age of Microbiology. 4. The Microbiology of the XX and XXI centuries.

Goals:

Define the concepts of Microbiology and microorganisms.

Make a brief historical development of Microbiology.

Know the future perspectives of Microbiology.

Topic 2. Microbial diversity. 1. Cell microorganisms: Microorganisms with prokaryotic cellular organization (bacteria and archaea) and eukaryotic (algae, fungi and microscopic protozoa).

Classification in the three domains of the universal tree of living beings. 2. Microorganisms without cellular organization: viruses and other acellular entities (prions, viroids, satellite viruses and satellite nucleic acids).

Goals:

Place the microorganisms among the rest of the living beings.

Highlight the differences between the prokaryotic and eukaryotic cells.

Define the main characteristics of biological entities lacking cellular organization.

THEMATIC BLOCK II. THE PROCARIOTO MICROORGANISMS: BACTERIA AND ARCHES

THEMATIC BLOCK IIA. MORPHOLOGY AND CELLULAR STRUCTURES

Topic 3. The prokaryotic cell. 1. General description. 2. Size, shape and associations.

Goals:

Describe the size, shape and associations of prokaryotic cells, and their general organization.

Topic 4. Cell envelope. 1. Extracellular polymers. 2. Cell wall. 3. Cytoplasmic membrane.



Goals:

Describe the concept, morphology, structure, chemical composition and functions of each of the components of the prokaryotic cell envelope.

Topic 5. Cytoplasm and cytoplasmic content. 1. Cytoplasm 2. Genetic material. 3. Ribosomes. 4. Reserve inclusions. 5. Cytoplasmic organelles.

Goals:

Describe the concept, morphology, structure, chemical composition and functions of each of the components of the cytoplasm.

Topic 6. Filamentous appendices. 1. Flagella: General description. Mobility by flagella and by other mechanisms. Taxies 2. Fimbria and pili: General description.

Goals:

Describe the concept, morphology, structure, chemical composition and functions of the filamentous appendages of the prokaryotic cell

Topic 7. Differentiated cells. 1. Concept of differentiated cell and types. 2. Bacterial endospore: General description. Sporulation and germination processes

Goals:

Describe the concept, morphology, chemical composition, structure and functions of the bacterial endospore.

THEMATIC BLOCK IIB. NUTRITION, METABOLISM AND GROWTH

Topic 8. Nutritional requirements of prokaryotes. 1. General concepts. 2. Nutrients: Water. Sources of carbon, nitrogen, sulphur and phosphorus. The mineral salts The iron. Organic factors of growth. 3. Nutritional classification.

Goals:

Describe the nutritional requirements of prokaryotes and perform the nutritional classification of them.

Topic 9. Chemoheterotrophic metabolism. 1. Breathing: General. Aerobic respiration Anaerobic respiration 2. Fermentation.

Goals:

Describe the general characteristics of the metabolism of prokaryotic chemo heterotrophs.

Highlight the differences between aerobic and anaerobic respiration.

Describe the different types of fermentations and their industrial use.

Topic 10. Chemolithotropic metabolism. 1. General concepts. 2. Biosynthesis reactions in chemoautotrophs (CO₂ fixation). 3. Reactions of energy metabolism: Breathing in chemolithotrophs.

Goals:

Describe some examples of the most representative groups of chemolithotrophs.

Theme 11. Metabolism of phototrophs. 1. General concepts. 2. Types of photosynthesis performed by prokaryotes.

Goals:



Briefly describe the different types of phototrophic metabolism of prokaryotes.

Topic 12. Cell and population growth. 1. Cell growth: 2. Population growth. 3. Growth in natural environments.

Goals:

Describe the bacterial cell cycle.

Develop the mathematical expression of population growth.

Explain the phases of population growth in closed or discontinuous systems

Define the concept of continuous cultivation and its applications.

Highlight the differences between the growth of microorganisms in artificial laboratory media and in natural environments.

Topic 13. Methods of counting microorganisms. 1. Direct techniques: 1.1. Counts to the microscope. Determination of bacterial mass. 2. Indirect techniques: Plate count of viable cells. Count by filtration membranes. Determination of the most probable number. Optical measurements. Other methods

Goals:

Describe the methods of counting microorganisms and their applications.

Point out that counting methods are useful to study the growth kinetics of a microorganism.

Topic 14. Action of physical agents on the growth of prokaryotes. 1. General concepts. 2.

Temperature. 3. Osmotic pressure, 4. pH. 5. Desiccation. 6. Radiation. 7. Others.

Goals:

Describe the influence of different physical agents on the growth and death of bacteria.

Explain how these physical agents determine the distribution of microorganisms in nature.

Indicate the use of different physical agents for the control of microorganisms.

THEME BLOCK IIC. GENETICS

Topic 15. Genetic recombination. 1. General concepts. 2. Types: Homologous or generalized. Site specific Transposition. 3. Restriction-modification system.

Goals:

Explain the basic concepts of genetic recombination.

Describe the different types of recombination that prokaryotes can experience and their consequences in the diversity of them.

Topic 16. Mutations. 1. General concepts. 2. types of mutations according to their molecular basis and according to their phenotypic effect.

2. Induced mutations: mutagenic agents and methods of selection of mutant strains. 3. Test of Ames.

Goals:

Define the concept and molecular basis of the mutations, as well as their phenotypic effects.

Describe the methods to artificially produce a mutation and select mutants.

Explain the Ames test and its application.

Topic 17. Horizontal genetic transfer. 1. General concepts. 2. Transformation. 3. Conjugation. 4.



Transduction

Goals:

To describe the different types of horizontal gene transfer among prokaryotes, explaining their general mechanism, biological significance and applications in genetic engineering.

THEMATIC BLOCK IID. TAXONOMY AND DIVERSITY

Topic 18. Taxonomy of prokaryotes. 1. General concepts. 2. Polyphasic taxonomy and the description of new species. 3. Taxonomic ranges. 4. Archaea and Bacteria domains.

Goals:

Describe the main methods and criteria used in the classification, nomenclature and identification of prokaryotic species.

Topic 19. Archaea domain. 1. General characteristics. 2. Some examples of the most representative archaea.

Goals:

Make a general description of archaea, its ubiquity and diversity.

Topic 20. Domain Bacteria. 1. Proteobacteria phylum. 2. Phylum Firmicutes. 3. Actinobacteria phylum. 4. Other edges.

Goals:

Make a general description of the main groups of bacteria, their ubiquity and diversity.

Taxonomically place the main bacteria that infect agricultural crops and / or contaminate food and, therefore, have clinical, veterinary or agricultural interest.

Taxonomically place the main bacteria that have biostimulant and bioprotective properties of vegetables.

Taxonomically locate the main bacteria that have an interest in the food industry.

THEMATIC BLOCK III. THE EUKARIOTES MICROORGANISMS: MICROSCOPIC FUNGI

Topic 21. Microscopic fungi. 1. Introduction. 2. General characteristics of fungi: Morphology and structure. Nutrition and metabolism. Habitats and life forms. Reproduction. Classification. 3. Clinical importance of fungi. 4. Industrial importance of fungi.

Goals:

Describe the general characteristics of fungi.

Quote some fungi of clinical interest.

Cite the main fungi of industrial interest.

THEMATIC BLOCK IV. VIRUSES AND OTHER ACELLULAR ENTITIES

Topic 22. Virus. 1. Concepts, general description and classification. 1. Viral infection and its consequences for the host cell. 3. Techniques for studying viruses. 4. Main viruses that affect humans. Viruses that infect agricultural crops.

Goals:

Differentiate viruses from cellular microorganisms.



Describe the components of viruses.

Define the criteria for virus classification.

Study the stages of the viral infection and its consequences.

Summarize the main techniques for studying viruses.

Taxonomically locate the main animal viruses that can be transmitted through water and / or food. Describe the viruses that affect plant crops

Topic 23. Sub virus entities. Prions Viroids. Satellite virus. Nucleic acids satellite.

goals

Differentiate between the different types of sub virus entities.

Describe its importance as human and plant pathogens.

THEMATIC BLOCK V. CONTROL OF MICROORGANISMS THROUGH CHEMICAL AGENTS

Topic 24. Sterilizing agents, disinfectants and antiseptics. 1. Antimicrobial agents. General concepts and classification. 2. Description of the main sterilizing agents, antiseptics and disinfectants. 3. Evaluation of the antimicrobial activity.

Goals:

Describe the different chemical agents used to sterilize, disinfect or as antiseptics; its mechanisms of action; and its applications.

Explain the methods of assessment of the antimicrobial activity of chemical agents.

Highlight the main agents used in the treatment of food.

Topic 25. Antimicrobial chemotherapeutic agents. 1. General concepts. 2. Antibacterial. 3.

Antifungals. 4. Antivirals. 5. Techniques for determining the activity of antimicrobial chemotherapeutic agents. 6. Resistance to antimicrobial agents.

Goals:

Describe the main antimicrobial agents that are used to treat microbial infections with special reference to those that cause water and contaminated food.

Explain the main mechanisms of resistance of microorganisms to antimicrobial chemotherapeutic agents, the current repercussion of this resistance in the dissemination of some diseases, as well as the most important measures for their control.

THEMATIC BLOCK VI. INTERACTIONS OF MICROORGANISMS

Topic 26. Interactions of microorganisms with each other and with other living beings. 1.

Symbiosis: General concepts. 2. Interactions between microorganisms: Types. Examples of some microbial interactions. 3. Interactions of microorganisms with animals: Human microbiota.

Pathogenic microorganisms of humans. 4. Interactions of microorganisms with plants:

Microorganisms beneficial for plants. Pathogenic microorganisms of vegetables.

Goals:

Describe the different relationships established by microorganisms with themselves and with other living beings.

Highlight that many relationships of microorganisms are beneficial and, sometimes, essential for



ecosystems and living beings.

SEMINARS (6 hours)

Seminar 1: Foods obtained through microbial fermentations (Block IIB).

Seminar 2: Application of physical agents in sterilization and sanitation, and in the prevention of contamination and / or proliferation of microorganisms in food (Block IIB).

Seminar 3: Microorganisms and transgenic foods (Block IIC).

Seminar 4: Major bacterial infections in Andalusian agriculture (Block IID).

Seminar 5: *Saccharomyces cerevisiae* (Block III).

Seminar 6: Importance of viruses and other acellular entities (viroids, satellite viruses and satellite nucleic acids) as pathogens of agricultural crops (Block IV).

COLLECTIVE TUTORIES

Tutoring 1: Presentation of the subject, teaching guide and standards.

Tutoring 2: Review of general concepts of metabolism.

Tutoring 3: Solving problems of population growth.

Tutoring 4: Preparation of the control exam.

Tutoring 5: Preparation of the final exam.

PRACTICAL TOPICS

Practice 1. Basic rules of work in the Microbiology Laboratory. Material and devices of use.

Preparation of culture media. Sterilization techniques

Practice 2. The cultivation of bacteria. Isolation techniques of pure cultures.

Practice 3. Observation of bacteria. Optical microscopy: fresh and staining tests.

Practice 4. Bacterial identification.

READING

FUNDAMENTAL BIBLIOGRAPHY

MADIGAN, M.T., MARTINKO, J.M., BENDER, K.S., BUCK, D.H. y STAHL, D.A. (2015). Brock. Biología de los microorganismos. 13ª edición. Pearson Prentice Hall. Madrid.

PRESCOTT, L.M., HARLEY, J.P. y KLEIN, D.A. (2004). Microbiología 5ª edición. Mac Graw Hill. Madrid.

PRATS, G. 2013. Nuevo libro de Microbiología y Parasitología Médicas. Editorial Panamericana. Madrid.

COMPLEMENTARY BIBLIOGRAPHY

MOSSEL, D.A.A., MORENO, B. Y STRUIJK, C.B. (2003). Microbiología de los alimentos. 2ª



Edición. Acribia. Zaragoza. España.

DOYLE, M.P., BEUCHAT, L.R. Y MONTVILLE, T.J. (2001). Microbiología de los alimentos.

Fundamentos y Fronteras. 1ª Edición. Acribia. Zaragoza. España

RAY B., BHUNIA A. (2008). Fundamentos de Microbiología de los Alimentos. 4ª Edición. Mc Graw Hill. Nueva York, USA.

RECOMMENDED INTERNET LINKS

Instituto de Salud Carlos III: http://www.isciii.es/htdocs/centros/epidemiologia/epi_sim.jsp

CDC. Centro para el control y la prevención de enfermedades infecciosas (EEUU):

<http://www.cdc.gov/spanish/>

Plataforma POMIF: <http://www.pomif.com/>

Sociedad Española de Microbiología (SEM) y Grupo Especializado de Microbiología de los Alimentos de la SEM: <http://www.semicrobiologia.org/>

