



Universitat de Lleida

DEGREE CURRICULUM **MICROBIOLOGY AND IMMUNOLOGY**

Coordination: TORRES GRIFO, MERCE

Academic year 2022-23

Subject's general information

Subject name	MICROBIOLOGY AND IMMUNOLOGY			
Code	100316			
Semester	1st Q(SEMESTER) CONTINUED EVALUATION			
Typology	Degree	Course	Character	Modality
	Double bachelor's degree: Bachelor's Degree in Veterinary Medicine and Bachelor's Degree in Science and Production	2	COMPULSORY	Attendance- based
Course number of credits (ECTS)	6			
Type of activity, credits, and groups	Activity type	PRALAB	PRAULA	TEORIA
	Number of credits	1.4	0.6	4
	Number of groups	4	2	1
Coordination	TORRES GRIFO, MERCE			
Department	FOOD TECHNOLOGY, ENGINEERING AND SCIENCE			
Teaching load distribution between lectures and independent student work	On-site hours: 60 Off-site hours: 90			
Important information on data processing	Consult this link for more information.			
Language	Català: 50% Castellano: 40% English: 10%			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
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Learning objectives

Students must be able to:

1. Recognize the members of the microbial world and the different cellular organizations
2. Explain bacterial reproduction
3. Discuss the microbial growth and the influence of environmental factors on growth
4. Explain the principles of bacterial classification. Indicate the main groups of archaeobacteria and eubacteria
5. Identify the fungi most related to mycology of animal foods
6. Describe the structure of viruses and their role in reproduction mechanisms, especially in animal viruses
7. Discuss the concept of microbial death and recognize the most used physical and chemical agents in microbial control.
8. Distinguish the interactions between microorganisms and hosts and analyze the mechanisms of the virulence
9. Name the fundamental characteristics of the immune system (organs, cells, and molecules)
10. Recognize the response mechanisms of the animal organism to pathogens

The student that exceeds the subject must be able to:

1. Use the main techniques of microbial cultivation

2. Apply the principles of immunology to the prevention of diseases and the welfare of animals.

Competences

Basic competences

CB1, CB2, CB3, CB4 and CB5

Generic competences

CG6 Development of the professional practice of the health, acquiring skills related to the work in team, making efficient of the resources and in management of quality.

CG7 Emerging risks identification in the wraps of the veterinary profession.

Specific competences

CE9. Know the microorganisms and parasites that affect animals and those who have an industrial, biotechnological or ecological application. Know the techniques of the immune response.

Transversals competences

CT1, CT2, CT3, CT4, CT5

Subject contents

LESSON 1. THE HISTORY AND SCOPE OF MICROBIOLOGY. The discovery of microorganisms. The spontaneous generation conflict. The recognition of the microbial role in disease. The composition of the microbial world. The scope and relevance of microbiology.

LESSON 2. PROCARYOTIC CELL STRUCTURE AND FUNCTION. Size, shape and arrangement. Procaryotic cell membranes. The procaryotic cell wall. Components external to the cell wall. The Cytoplasmic matrix. The nucleoid. The bacterial endospore.

LESSON 3. NUTRITION, METABOLISM AND MICROBIAL CULTURE. Bacterial nutrition. The common nutrient requirements. Nutritional types of microorganisms. Organic growth factors. The role of oxygen in nutrition. Culture media. Isolation of pure cultures. The influence of environmental factors on growth.

LESSON 4. MICROBIAL GROWTH. Definition of microbial growth. Nature and mathematical expression of growth. The growth curve. Diauxic growth. Measurement of microbial growth. The continuous culture of microorganisms

LESSON 5. BACTERIAL TAXONOMY. The concept of species in microbiology. Nomenclature and Bergey's Manual. *Archae: the methanogens, the halobacteria and the hyperthermophile*. *Bacteria*: (a) The Proteobacteria: *Pseudomonas* and relatives. The acetic acid bacteria. Enterobacteria. *Vibrio* and *Photobacterium*. *Campylobacter* and *Helicobacter*. (b) Gram positives: The Clostridia and relatives, The Bacilli and Lactobacilli. The high G+C Gram positives: corineforms and acid propionic bacteria, *Mycobacterium*; *Streptomyces*; Bifidobacteria.

LESSON 6. THE FUNGI. Yeasts and molds. Morphology. Reproduction. Physiology. Classification: important genera.

LESSON 7. THE VIRUSES. General properties of viruses. Virion: nucleic acid, capsid and other structures. Viral

replication. Principles of virus taxonomy. The cultivation of viruses. Virus purification and assays. Animal viruses.

LESSON 8. CONTROL OF MICROBIAL GROWTH. Antimicrobial function of physical agents: heat and radiations. Antimicrobial function of chemical agents: disinfectants. Properties of chemiotherapeutic agents. Microbiostatic and microbicide agents. Measure of the antimicrobial action. Synthetic chemiotherapeutic agents. Antibiotics: range of action and mechanisms. Resistance to antibiotics.

LESSON 9. ECOLOGY OF MICROBIAL INFECTIONS. Microbiota in animal organisms. Pathogenesis and virulence. Opportunistic pathogens. The chain of infection of a host. Factors that influence invasion. Bacterial toxins: types and mechanisms of action. Physical and chemical mechanisms against infection.

UNIT 10. INTRODUCTION TO IMMUNOLOGY. Introduction to immunology. Elements of the immune system. Organs and tissues of the immune system. Cells. Molecules. Definition of natural or primary immunity and acquired or adaptive immunity. Evolution of immunity in species

UNIT 11. INNATE IMMUNITY. Natural resistance mechanisms. Phagocytosis. Pattern recognition receptor (PRR). Inflammatory response. Antimicrobial chemical components. Acute phase proteins. Mast cells.

UNIT 12. COMPLEMENT Concept. Classic way and Alternative way of complement activation. Regulation of the complement system. Receptors of the complement system.

UNIT 13. IMMUNITY ACQUIRED. ANTIGEN PRESENTING CELLS (APCS). MHC MOLECULES. PROCESSING AND PRESENTATION OF ANTIGENS 1h Main characteristics of acquired immunity. Definition of immunogen, antigen, hapten, and epitope. Antigen presenting cells. Functions and varieties according to their anatomical location. Markers. Initiation of the acquired response. Definition and function of the MHC. MHC class I molecules. MHC class II molecules. Processing routes The MHC of domestic animals.

UNIT 14. T and TCR LYMPHOCYTES. Generalities. Lymphocytes, types of lymphocytes, phenotypic and functional study of lymphocytes. T lymphocytes: Definition. Properties Ontogeny and maturation of T lymphocytes. Thymic selection. T lymphocyte receptor (TCR). Interaction TCR, MHC and accessory molecules. CD subpopulations.

UNIT 15. LYMPHOCYTES B AND IMMUNOGLOBULINS. ANTIGEN-ANTIBODY INTERACTION. B lymphocytes: Ontogeny and maturation of B lymphocytes. Function to the immune response. Plasma cells and antibody production. Immunoglobulins Molecular structure. Nomenclature. Properties and biological activities of immunoglobulins. Immunoglobulins in domestic animals. Antigen-antibody interaction.

UNIT 16. ADHESION MOLECULES, CYTOKINES AND CHEMOKINES. Adhesion molecules. Definition and function Families. Definition of cytokines and chemokines. Definition and classification. Inflammatory cytokines and natural response. Cytokines of the specific response.

UNIT 17. ORGANS AND TISSUES OF THE IMMUNE SYSTEM. Primary and secondary organs. Thymus, bone marrow, lymph nodes, spleen, MALT. Circulatory system of immune system cells: lymphatic and blood vessels.

UNIT 18. IMMUNE RESPONSE TO MICROBIAL AND PARASITARY ANTIGENS. Microbial antigens and immune mechanisms against bacterial antigen infections. Study of viral antigens and immune mechanisms against viral infections. Fungal antigens and immune mechanisms against mitotic infections. Parasitic antigens and immunological mechanisms against parasitosis.

UNIT 19. NON-MICROBIAL IMMUNOLOGY. LOCAL IMMUNITY AND OTHER IMMUNOLOGICAL ASPECTS. Local immune mechanisms. Immunity against tumors. Reproductive immunology. Immunity in the fetus and the newborn.

UNIT 20. IMMUNOLOGICAL TOLERANCE AND SELF-IMMUNITY. IMMUNODEFICIENCY CONCEPT. Regulatory mechanisms: immunological tolerance. Tolerance in T and B lymphocytes: central tolerance and peripheral tolerance. Maternal-fetal tolerance. Mechanisms of induction of autoimmunity. Immunopathological disorders: Immunodeficiencies and immune deficit.

UNIT 21. IMMUNE SYSTEM CHANGES. Hypersensitivity reactions (concept and classification). Type I hypersensitivity (anaphylactic or atopic). Type II hypersensitivity (cytotoxic or cytolytic). Type III hypersensitivity (through complexes). Type IV hypersensitivity (through cells or delayed). Nonspecific hypersensitivity.

UNIT 22. IMMUNODIAGNOSTIC TECHNIQUES. Primary reactions Immunofluorescence. Flow cytometry. Radioimmunoassay. Enzyme immunoassay. Seroprofiles and its application in veterinary medicine. Immunohistochemistry. Secondary reactions. Precipitation. Immunodiffusion. Agglutination. Inhibition of hemagglutination. Fixing of the complement. Neutralization and serum neutralization.

UNIT 23. IMMUNIZATION SYSTEMS Vaccines and antiserumtherapy. Types of vaccines. Post-vaccination diagnostic problems. New strategies in vaccine development. Immunomodulators

Laboratory practical classes

Practice 1. The microbiology laboratory. Handling of the material and microorganisms. Work attitude

Practice 2. Diferencial stains.

Practice 3. Bacterial count for the Most Probable Number Technique

Practice 4. Membrane Filter Technique for detection of fecal streptococi

Practice 5. Determination of Aerobic Mesophilic Bacteria in feed

Pràctice 6. Observation and classification of Molds.

Pràctice 7. Antibigram

Pràctice 8. Use of biochemical tests to identify Enterobacteria.

Pràctice 9. Characterization of microorganisms: types of hemolysis and catalase and coagulase tests.

Practice 10. Histology of the immune system

Practice 11. Immunological techniques to measure the humoral and cellular immune response

Practice 12. Hypersensitivity reactions.

Practice 13. Vaccines.

Methodology

The development of this subject will be mainly theory classes, laboratory practical classes and seminars. Theory classes will be done during the programmed timetable for this subject, and will be mainly expositive.

For some lessons, a Directed Activity will be also proposed; in this case, the student will do an activity following specific instructions. Theory knowledge will be amplified with the analysis of some example cases.

Laboratory practical classes are mandatory; therefore, they must be performed in order to pass this subject. One part of the practical classes will be performed during the programmed timetable for the subject, but others will be intensive during one week, that will be also programmed.

The following individual protection equipments (EPIs) are mandatory. Students have to wear them during practical classes:

- Unisex white labcoat.
- Eye protection glasses.
- Biological / Chemical protection gloves.

Development plan

Tipus Activitat	Descripció resumida de l'activitat (Títol de tema o activitat pràctica)	Dedicació (hores)	Setmana
TEO	T1. Introducció. El món microbià	1	1
TEO	T2. Morfologia i estructura dels bacteris	4	1/2
TEO	T3. Nutrició, metabolisme i cultiu microbià	2	2
TEO	T4. Creixement bacterià	2	2/3
TEO	T5. Taxonomia bacteriana	4	3/4
TEO	T6. Fongs	2	4
TEO	T7. Virus	4	4/5
PLB*	P1 a P7	9*	5
TEO	T8. Control microbià	2	5
ACD	Treball		
TEO	T9. Ecologia de les infeccions microbianes	2	6
TEO	T10. Introduction to immunology.	1	7
TEO	T11. Organs and tissues of the immune system	2	8
TEO	T12. Innate immunity	2	9
TEO	T13. Complement	2	10
TEO	T14. Lymphocytes B and Immunoglobulins ...	2	10
PRA	P10.	2	11
TEO	T15. APCs and MHC	2	12

PRA	P8-9	3	12
PRA	P11	2	13
TEO	T16. LymphocytesT and TCR	1	13
TEO	T17. Adhesion molecules, cytokines...	1	13
PRA	P12.	2	14
TEO	T18. Pathogen response	2	15
TEO	T19. Immunological tolerance	2	16
PRA	P13.	2	16

TEO: teoria;

PRO: Problemes i casos

SEM: Seminari;

INF: Informàtica;

CAM: Camp;

VIS: Visites;

ACD: Activitat dirigida

LAB: Pràctiques de laboratori

Evaluation

1. Three writing tests (25%, 10% and 25%).
2. Laboratory practical classes are mandatory and indispensable to be able to do the writing tests. The work in the laboratory and a report with results and conclusions will be evaluated (25%).
3. Analysis of example cases (15%).

Observations

In order to pass the evaluation, three requirements are indispensable:

- i) laboratory practical classes have to be done,
- ii) a minimum score of 5/10 in writing tests must be obtained (with a minimum of 4/10 in each individual writing test),
- iii) a minimum of 5/10 as a global score must be obtained.

Bibliography

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