

## 28409 - Micro-biology and Immunology

### Información del Plan Docente

Academic Year	2017/18
Faculty / School	105 - Facultad de Veterinaria
Degree	451 - Degree in Veterinary Science
ECTS	9.0
Year	2
Semester	Annual
Subject Type	Compulsory
Module	---

### **1.General information**

#### **1.1.Introduction**

#### **1.2.Recommendations to take this course**

#### **1.3.Context and importance of this course in the degree**

#### **1.4.Activities and key dates**

### **2.Learning goals**

#### **2.1.Learning goals**

#### **2.2.Importance of learning goals**

### **3.Aims of the course and competences**

#### **3.1.Aims of the course**

#### **3.2.Competences**

### **4.Assessment (1st and 2nd call)**

#### **4.1.Assessment tasks (description of tasks, marking system and assessment criteria)**

### **5.Methodology, learning tasks, syllabus and resources**

#### **5.1.Methodological overview**

The process of learning is based on:

The course is divided into 60 one-hour participatory lectures, 1 hours of seminars in which students prepare the subject in small groups, expose and respond to questions, and 29 hours of laboratory work.

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Documentation for each topic is hosted within the Moodle 2 platform, under the name of the course. Thus, the student can access to it whenever s/he wants along the academic year. The available material consists of a comprehensive set of Power Point notes including all the basic concepts reviewed during the lecture. Student participation will be encouraged during the lecture through problem-based learning activities.

Laboratory practices (Microbiology 1-6) will be carried out in one-hour and a half sessions, duplicated in next day. Moreover, Laboratory practices (Immunology 1-5) will be carried out in two-hour and a half sessions. As for the lecture materials, supporting laboratory documentation will be host within the Moodle 2 platform.

In order to maintain permanent contact with students, both the use of electronic mail and personal tutorials are available. In addition, all available supporting material either for individual or group work (seminars) will be provided to the students.

### **5.2.Learning tasks**

To achieve the expected results the course program includes the following activities:

#### THEORETICAL AGENDA

The lectures correspond to 60 hours. They cover the following topics, classified into three parts of the subject:

#### A) GENERAL MICROBIOLOGY AND B) MICROBIOLOGICAL DIAGNOSTIC

General Descriptors for A and B:

Procariotic and eucariotic organisms. Microscopic examination of bacteria. Chemical bacterial composition. Bacterial physiology. Bacterial nutrition. Bacterial reproduction. Bacterial genetics. Factors produced by bacteria. The control of bacterial populations. Bacterial identification. Bacterial taxonomy. Fungi.

Competences:

The aim of these two first parts of the subject is to acquaint the student with the general characteristics of bacteria, viruses and fungi within the microbial world, their taxonomic status, constitution, observation methods, management, metabolism, mechanisms for exchanging information and their influence in relation to food and animals.

Teaching-learning activities:

36 one-hour lectures (General Microbiology) and 4 one-hour lectures (Microbiological Diagnostic)

18 hours of laboratory work (microorganisms management and identification)

Regarding the blocks in which the contents of the first part of the course is presented are:

#### A) GENERAL MICROBIOLOGY

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### BLOCK I. GENERAL MICROBIOLOGY AND MICROBIOLOGICAL TECHNIQUES AND TOOLS

Current concept and historical evolution. Diversity of the microbial world. Microbiology in the current scientific context. Division of Microbiology. Microscopic examination of bacterial and fungal microorganisms.

BLOCK II. GENERAL BACTERIOLOGY. Bacterial taxonomy. Bacterial structure and Anatomy. Chemical bacterial composition. Bacterial physiology. Bacterial nutrition. Bacterial reproduction. Bacterial genetics. Factors produced by bacteria. The control of bacterial populations. Bacterial identification. Bacterial biology. Toxinogenesis.

BLOCK III. SPECIAL AND TAXONOMIC BACTERIOLOGY: Different bacterial groups. Microorganisms involved in Animal Health and Public Health.

BLOCK IV. GENERAL AND TAXONOMIC MYCOLOGY: The aim of this second block is to acquaint the student with the general characteristics of fungi, its constitution, methods of observation, management, metabolism, mechanisms for exchanging information and their role in relation to the animals. Fungi that produces deep, superficial and subcutaneous mycoses. Mycotoxins and mycotoxicosis.

BLOCK V. SPECIAL AND TAXONOMIC VIROLOGY. Concept and historical development. Nature and structure of viruses. Viral classification. Viral genetics. Methods of study of viruses. Replication of animal viruses. Techniques for virus cultures. Bacteriophages. General Clinic presentations of viral infections. General methods of diagnosis for virus diseases. Viral inactivation. DNA viruses and RNA viruses.

BLOCK VI. PRION: Prion concept. Properties of prions. Replication. Bovine Spongiform Encephalopathy. Scrapie.

The second part of the course is MICROBIOLOGICAL DIAGNOSIS (B): BLOCK VIII. MICROBIOLOGICAL DIAGNOSTIC

The experimental disease and microbiological techniques: Laboratory animals (study and use). Basic rules for the collection and transport of pathological microbiological samples. Safety in the microbiology laboratory. Methods Gram and Ziehl-Neelsen. Biochemical tests for bacterial identification. Antibiograma. Polymerase chain reaction. (P.C.R.) in Microbiology. Methods of study of fungi. Virus: Observation techniques, culture, isolation and identification. Methods of study of viruses. Hemagglutination and Haemadsorption. Virus titration. General methods of diagnosis of virus diseases. Inhibitors of viral replication. Viral inactivation. Immunological tests for the diagnosis of animal diseases. Immunoreactions: Agglutination and precipitation. Immunofluorescence reactions: fundamentals and techniques. Enzyme immunoassays. Vaccine development.

The third part of the course, C) IMMUNOLOGY

General descriptors:

Basic principles and applied of the immune response, with special emphasis on the innate and acquired mechanisms involved in the immune response against microorganisms of veterinary clinical significance, on the techniques performed for diagnosis, on immunopathology and finally, on immunoprophylaxis methods. Knowing the basics of the different biological agents of veterinary interest.

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### Competences:

The aim of this part of the course is that students will be able to perform basic techniques of immunological diagnosis to enable it to assess the state of general and specific immunity of an animal. Also, to be able to diagnose the most common diseases by using various general and instrumental techniques; and predict the immune status of an animal against a microorganism and its responsiveness to different kinds of immunogens.

### Teaching-learning activities:

20 one-hour lectures

11 hours of laboratory work

Blocks in which the content of the third part of the subject (C, IMMUNOLOGY) is presented are:

**BLOCK VIII. GENERAL IMMUNOLOGY:** History and current concept. Mechanisms of natural immunity. The inflammation. Acquired immunity. Characters of the antigenic molecule. Antigens and Major Histocompatibility Complex. Immunocompetent cells. Lymphoid organs. Antibodies. Immunoglobulins. Antibody synthesis. The complement..

**BLOCK IX. IMMUNOPATHOLOGY:** Immune system disorders. Hypersensitivity reactions. Autoimmunity. Immunodeficiencies.

**BLOCK XI. IMMUNE RESPONSE AGAINST MICROBIAL AND PARASITIC ANTIGENS:** bacterial, viral, fungal and parasite antigens. **BLOCK XII. IMMUNOLOGY NOT RELATED WITH MICROORGANISMS IMMUNITY AND OTHER LOCAL IMMUNOLOGICAL ASPECTS:** Immunity related with transplants. Tumor immunity. Local immune mechanisms.

**BLOCK XII. EVALUATION OF THE IMMUNE RESPONSE:** Antigen-antibody interaction. Serological reactions.

**BLOCK XIII. APPLIED IMMUNOLOGY:** Immunoprophylaxis. Serological prevention and serological diagnostic. Immunomodulation and immunosuppression. Allergies.

Individual work from the theoretical program: 120 hours

### PRACTICAL PROGRAMME

It has 30 hours of compulsory student attendance. They will be developed in the laboratories of the Microbiology and Immunology Unit, established groups in advance by the Secretariat of the Centre. The content of the practical sessions is as follows:

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### A) GENERAL MICROBIOLOGY AND B) MICROBIOLOGICAL DIAGNOSTIC

Six practice sessions will be held on two consecutive days and will last an hour and a half each day.

1. Standards for working at microbiology laboratories. Common material and equipment. Cleaning and maintenance of equipments. Distribution of laboratory areas. Equipment sterilization and preparation of culture media. The handling of the optical microscope. Simple staining.
2. Sampling. Culture of aerobic and anaerobic microorganisms on solid medium and broth. Plating techniques. Gram staining. Special staining. Microscopic observation of bacteria.
3. Identification of bacterial microorganisms. Biochemical and physiological identification. Conventional systems, API galleries.
4. Quantitative study of bacterial populations. Bacterial colonies counting by filtration. Environmental Microbiology: air sampling (gravimetric and volumetric techniques) and surface sampling.
5. Systems for assessment the antimicrobial susceptibility. Techniques: plate (Kirby-Bauer method), minimum inhibitory concentration (MIC) and minimum bactericidal concentration (CMB). Bacterial genetics (bacterial transformation).
6. Identification of fungi and yeasts.

### C) INMUNOLOGY

Five practical sessions (in the latter, seminars lasting 1hr develop), and will last 2h30 'will be held.

- 1.- Agglutination and precipitation techniques on serological reactions
- 2.- Immunofluorescence technique on serological reactions
- 3.- Microorganism identification through immunological reactions. This practice will be taught in English.
- 4.- Vaccination principles. Immunization systems.
- 5.- Seminar on tutored projects, presented by the students. Individual work: 5 hours spent reviewing the different topics in the seminars.

### PERSONAL TUTORIALS

A fixed schedule for personal tutorials is not set, however professors will be available to students by appointment and through email.

### 5.3.Syllabus

Lectures

#### A) GENERAL MICROBIOLOGY

##### Block I: GENERAL MICROBIOLOGY AND MICROBIOLOGY TECHNIQUES

Lecture 1. Introduction to Veterinary Microbiology.

Lecture 2. Microscopic examination of bacteria.

##### Block II: GENERAL BACTERIOLOGY

Lecture 3. Prokaryotic and eukaryotic organisms.

Lectures 4 and 5. Constant elements of bacteria.

Lecture 6. Inconstant elements of bacteria.

Lecture 7. Chemical constitution of bacteria.

Lecture 8. Bacterial physiology and metabolism for synthesis.

Lecture 9. Bacterial nutrition.

Lecture 10. Bacterial reproduction.

Lecture 11. Physical and chemical agents that act on the life of microorganisms.

Lecture 12. The genetic transfer phenomena.

Lecture 13. Bacterial and extrabacterial factors.

Lecture 14. Toxinogenesis

##### BLOCK III. SPECIAL AND TAXONOMIC BACTERIOLOGY

Lecture 15. Bacterial taxonomy.

#### GRAM NEGATIVAS BACTERIA

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Lecture 16. PROTEOBACTERIAS: a y b-PROTEOBACTERIAS.

Lecture 17. *g* - PROTEOBACTERIAS.

Lecture 18. *e* - PROTEOBACTERIAS.

Lecture 19. CLAMIDIAS, FUSOBACTERIAS AND BACTEROIDES.

FLEXIBACTERIAS Y ESPIROQUETAS

Lecture 20. FLEXIBACTERIAS y ESPIROQUETAS

BACTERIAS GRAM POSITIVAS

Lectures 21 and 22. Low G+C Gram Positive Bacteria

Lecture 23. High G+C Gram Positive Bacteria

Block IV: SPECIAL AND TAXONOMIC MICOLOGY

Lecture 24. Mycology. General characteristics of fungi.

Lecture 25. Fungi that produces deep, superficial and subcutaneous mycoses.

Lecture 26.- Mycotoxins and mycotoxicosis.

B) MICROBIOLOGY DIAGNOSTIC

C) Block VII MICROBIOLOGY DIAGNOSTIC

Lecture 27.- Bacteriology and Micology Diagnostic. Case reports.

A) GENERAL MICROBIOLOGY

Block V: SPECIAL AND TAXONOMIC VIROLOGY and Block VII MICROBIOLOGY DIAGNOSTIC

Lecture 28.- General virology.

Lecture 29.- General Pathology of virus diseases.

Lecture 30.- Animal viruses replication.

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Lecture 31. Bacteriophages.

Lectures 32 y 33.- DNA/2 and DNA/1viruses.

Lecture 34.- RNA/1 viruses (inverse transcriptase).

Lecture 35.- .- RNA/1 viruses (negative sense).-

Lecture 36 and 37.- RNA/1 viruses (positive sense).-

Block VI: PRIONS

Lecture 38.- Prions

B) INMUNOLOGY

Block VIII GENERAL INMUNOLOGY

Lecture 39.- Immunology. History and current concept.- Types of immunity.

Lecture 40.- Mechanisms of the Natural Immunity.

Lecture 41.- Acquired Immunity: characteristics.

Lecture 42.- Antigen and Major Histocompatibility Complex.- Blood types.

Lecture 43.- Immunocompetent cells.- Myeloid and lymphoid lineages.- T and B lymphocytes.

Lecture 44.- Others immunocompetent cells: ADCC, NK cells, Citokines. Lymph organs.

Lecture 45.- Antibodies

Lecture 46.- Domestic animals Immunoglobulins

Lecture 47.- Theories of antibodies synthesis.

Lecture 48.- Complement. System.

Block IX IMMUNOPATHOLOGY

Lecture 49.- Immune system disorders. Hypersensitivity reactions type I y II.



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Lecture 50.- Type III and Type IV Hypersensitivity reactions. Inespecific Hypersensitivity reaction.

Lecture 51.- Autoimmunity. Immunodeficiencies.

**Block X IMMUNE RESPONSE AGAINST MICROBIAL AND PARASITIC ANTIGENS:**

Lecture 52.- Synthesis of microbial antigens and immunological mechanisms against infections of bacterial, viral, fungal and parasitic antigens..

**Block XI IMMUNOLOGY NOT RELATED WITH MICRORGANISMS. IMMUNITY AND OTHER LOCAL IMMUNOLOGICAL ASPECTS:..**

Lecture 53.- Immunity related with transplants.Tumors and aging related immunity.

Lecture 54.- Local immune mechanisms.

**Block XII EVALUATION OF THE IMMUNE RESPONSE:**

Lecture 55- Antigen-antibody interaction. Serological reactions.

**Block XIII APPLIED IMMUNITY**

Lecture 56.- Immunoprophylaxis.

Lecture 57.- Serological prevention and serological diagnostic.

Lecture 58.- Immunosuppression.

**B) Block VII MICROBIOLOGY DIAGNOSTIC**

Lecture 59.- Immunological tests for microbial identification.

Practical sessions

**A) GENERAL MICROBIOLOGY AND B) MICROBIOLOGICAL DIAGNOSTIC**

Session 1. Standards for working at microbiology laboratories. Common material and equipment. Cleaning and maintenance of equipments. Distribution of laboratory areas. Equipment sterilization and preparation of culture media. The handling of the optical microscope. Simple staining.

Session 2. Sampling. Culture of aerobic and anaerobic microorganisms on solid medium and broth. Plating techniques. Gram staining. Special staining. Microscopic observation of bacteria.

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Session 3. Identification of bacterial microorganisms. Biochemical and physiological identification. Conventional systems, API galleries.

Session 4: Quantitative study of bacterial populations. Bacterial colonies counting by filtration. Environmental Microbiology: air sampling (gravimetric and volumetric techniques) and surface sampling.

Session 5: Systems for assessment the antimicrobial susceptibility. Techniques: plate (Kirby-Bauer method), minimum inhibitory concentration (MIC) and minimum bactericidal concentration (CMB). Bacterial genetics (bacterial transformation).

Session 6. Identification of fungi and yeasts.

### **C) INMUNOLOGY**

Session 1.- Agglutination and precipitation techniques on serological reactions

Session 2.- Immunofluorescence technique on serological reactions

Session 3.- Microorganism identification through immunological reactions. This practice will be taught in English.

Session 4.- Vaccination principles. Immunization systems.

Session 5.- Seminar on tutored projects, presented by the students.

## **5.4.Course planning and calendar**

### **Schedule of lectures, paper presentations and exams**

**The dates and key milestones of this subject are described in detail, along with the other subjects of the second year in the in the Faculty of Veterinary Medicine website**

**Planning MICROBIOLOGÍA subject in ECTS**

**Credits: 9 ECTS (225 hours of student work)**

**Students and groups: 150 students, two groups of theoretical teaching and 12/24 of practical teaching.**

Experimentality factor: 3

## 5.5. Bibliography and recommended resources

[BB: Bibliografía básica / BC: Bibliografía complementaria]

- [BB] Atlas of clinical fungi / G. S. de Hoog ... [et al.] . 2nd ed. Utrecht : Centraalbureau voor Schimmelcultures ; Reus, España : Universitat Rovira i Virgili, cop. 2000
- [BB] Bergey's manual of systematic bacteriology . Volume one, The ?Archaea? and the deeply branching and phototropic ?Bacteria? / David R. Boone, Richard W. Castenholz, editors volume two ; George M. Garrity, editor-in-chief ; editorial board, James T. Staley ... [et al.] . New York : Springer , cop. 2001
- [BB] Bergey's manual of systematic bacteriology . Volume two, The proteobacteria . Part A , Introductory essays / Don J. Brenner, Noel R. Krieg, James T. Staley, editors volume two ; George M. Garrity, editor-in-chief ; editorial board, James T. Staley ... [et al.] . New York : Springer , cop. 2005
- [BB] Bergey's manual of systematic bacteriology . Volume two, The proteobacteria . Part B , c / Don J. Brenner, Noel R. Krieg, James T. Staley, editors volume two ; George M. Garrity, editor-in-chief ; editorial board, James T. Staley ... [et al.]. New York : Springer , cop. 2005
- [BB] Bergey's manual of systematic bacteriology . Volume two, The proteobacteria . Part C , The Alpha-, Beta-, Delta -, and Epsilonproteobacteria / Don J. Brenner, Noel R. Krieg, James T. Staley, editors volume two ; George M. Garrity, editor-in-chief ; editorial board, James T. Staley ... [et al.]. New York : Springer , cop. 2005
- [BB] Brock : Biología de los microorganismos / Michael T. Madigan ... [et al.] ; coordinación Ricardo Guerrero ; traducción Coral Barrachina ... [et al.] ; revisión técnica, Francisco Ruiz Berraquero. - 12ª ed., reimp. Madrid [etc.] : Pearson Education, D. L. 2011
- [BB] Diagnóstico microbiológico : texto y atlas en color / Washington C. Winn ... [et al.] ; 6ª ed. Buenos Aires ; Madrid [etc.] : Editorial Médica Panamericana, cop. 2008
- [BB] Inmunología / David Male ... [et al.] . 8ª ed. Barcelona : Elsevier, D. L. 2013
- [BB] MacFaddin, Jean F.. Pruebas bioquímicas para la identificación de bacterias de importancia clínica / Jean F. MacFaddin ; [traducción de Silvia Rondinone y Octavio Giovaniello] . 3ªed. Buenos Aires [etc.] : Ed. Médica Panamericana, 2003
- [BB] Manual de inmunología veterinaria / coordinadoras Esperanza Gómez-Lucía, María del Mar Blanco, Ana Doménech . Madrid [etc.] : Pearson, D.L. 2007
- [BB] Manual de microbiología veterinaria / Santiago Vadillo Machota, Segundo Píriz Durán, Emilio M. Mateos Yanes . Madrid [etc.] : McGraw-Hill - Interamericana, D.L. 2002
- [BB] Microbiología y enfermedades infecciosas veterinarias / P. J. Quinn... [et al.] . Zaragoza: Acribia, imp. 2005
- [BB] Mycotoxicoses in animals economically important / Edlayne Gonçalez, Joana D'Arc Felicio and Simone Aquino, editors . New York : Nova Science Publishers, cop. 2010
- [BB] Tizard, Ian R.. Inmunología veterinaria / Ian R. Tizard ; [revisión científica y técnica, Esperanza Gómez-Lucía Duato] . 8ª ed. Barcelona : Elsevier, cop. 2009
- [BB] Tortora, Gerard J.. Introducción a la microbiología / Gerard J. Tortora, Berdell R. Funke, Christine L. Case ; [traducción de Silvia Cwi ... (et al.)] . 9ª ed. Buenos Aires [etc.] : Editorial Médica Panamericana, cop. 2007
- [BB] Veterinary microbiology and microbial disease / P. J. Quinn ... [et al.] . 2nd ed. Oxford : Wiley-Blackwell, cop. 2011
- [BB] Virología veterinaria / Frank Fenner ... [et al.] . [1ª ed.] Zaragoza : Acribia, D.L. 1992
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- [BB] Webster, John. Introduction to fungi / John Webster . 2nd ed., repr. Cambridge [etc.] : Cambridge University Press, 1993