

**COURSE DATA****Data Subject**

<b>Code</b>	34464
<b>Name</b>	Medical microbiology and parasitology
<b>Cycle</b>	Grade
<b>ECTS Credits</b>	6.0
<b>Academic year</b>	2022 - 2023

**Study (s)**

<b>Degree</b>	<b>Center</b>	<b>Acad. year</b>	<b>Period</b>
1204 - Degree in Medicine	Faculty of Medicine and Odontology	2	Second term

**Subject-matter**

<b>Degree</b>	<b>Subject-matter</b>	<b>Character</b>
1204 - Degree in Medicine	11 - Diagnostic and therapeutic procedures	Obligatory

**Coordination**

<b>Name</b>	<b>Department</b>
BORRAS SALVADOR, RAFAEL	275 - Microbiology and Ecology
BUESA GOMEZ, FRANCISCO JAVIER	275 - Microbiology and Ecology
GIMENO CARDONA, CONCEPCION	275 - Microbiology and Ecology

**SUMMARY**

The objectives of the subject “Microbiology and Medical Parasitology” are:

- To provide the scientific knowledge that a general doctor must have about: I) Biological and pathogenic aspects of the organisms producers of diseases in the human being; II) Laboratory diagnosis and the bases of etiological treatment of the infectious and parasitic diseases.
- To facilitate the acquisition of necessary basic practices for the study of the microorganisms and los parasites of medical interest.



## PREVIOUS KNOWLEDGE

### Relationship to other subjects of the same degree

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

### Other requirements

To pursue this matter, is recommended to students having passed the following subjects:

1. Biology
2. Biochemistry

## OUTCOMES

### 1204 - Degree in Medicine

- Understand and recognise source agents and risk factors which determine health status and the development of diseases.
- Establish the diagnosis, prognosis and treatment, applying principles based on the best information available and on conditions of clinical safety.
- Know how to use the sources of clinical and biomedical information available, and value them critically in order to obtain, organise, interpret and communicate scientific and sanitary information.
- Know how to use IT in clinical, therapeutic and preventive activities, and those of research.
- Keep and use medical records which contain information about the patient for later analysis, preserving the confidentiality of personal data.
- In the professional practise, take a point of view which is critical, creative, constructive and research-oriented.
- Understand the importance and the limitations of scientific thinking in the study, prevention and management of diseases.
- Be able to formulate hypothesis, gather information and evaluate it critically in order to solve problems by following the scientific method.
- Establish a good interpersonal communication which may allow professionals show empathy and talk to the patients efficiently, as well as to their relatives, the media and other professionals.
- Proper organisation and planning of the workload and timing in professional activities.
- Team-working skills and engaging with other people in the same line of work or different.
- Criticism and self-criticism skills.
- Capacity for communicating with professional circles from other domains.
- Acknowledge diversity and multiculturality.



- Consideration of ethics as a fundamental value in the professional practise.
- Working capacity to function in an international context.
- Evaluate the risk-benefit balance of diagnostic and therapeutic procedures.
- Is aware of the indications in biochemical tests, as well as haematological, immunological, microbiological, anatomical and pathological, and image tests.
- Knows the bases of microbiology and parasitology.
- Is aware of the main techniques of microbiological and parasitological diagnosis and interprets the results.
- Knows how to use medicines properly. Analgesic, antineoplastic, antimicrobial and anti-inflammatory drugs.
- Knows how to obtain and process a biological sample for its study through several diagnostic procedures.
- Is able to interpret results of diagnostic tests in the laboratory.
- Knows how to manage disinfection and sterilisation techniques.

## LEARNING OUTCOMES

The expected learning results from the different developed parts will be:

1. Knowledge of the basic biological characteristics of the microbes and parasites of medical interest.
2. Knowledge of the pathogenic mechanisms of the microbes and parasites of medical interest, and their clinical translation.
3. Knowledge of the molecular targets of the antimicrobials and antiparasites of medical interest, and of the resistance mechanisms.
4. Capacity to develop determined diagnostic basic methods of the infectious and parasitizing diseases.

## DESCRIPTION OF CONTENTS

### 1. SECTION I: MICROBES, PARASITES AND HUMANS (4 lessons)

Lesson 1.- Introduction to Medical Microbiology and Parasitology.- Historical evolution. Differences between prokaryotic and eukaryotic cellular organization. Kingdoms of nature and location of the human pathogenic organisms. Concepts of Microbiology, Parasitology and Medical Microbiology.

Lesson 2.- Relation host-parasite.- Types of interactions. Normal human microbiota. Koch's postulates. Concepts of pathogenesis: pathogenicity, virulence, colonization, infection and infestation; commensalism and parasitism. Factors responsible for pathogenicity.

Lesson 3.- Host response against microbes and parasites.- Immunological aspects of viral, bacterial, fungal and parasitic infections. Effector mechanisms and survival of the parasite. Nonspecific and



specific defense mechanisms.

Lesson 4.- Methods to study infections.- Direct microbiological diagnostics. Diagnosis by antibody detection and its applications in clinical microbiology.

## **2. SECTION II: MEDICAL BACTERIOLOGY (11 lessons)**

Lesson 5.- General Bacteriology I.- Morphology, grouping and staining affinity of the bacteria. Composition and function of the external, superficial and internal bacterial structures. Plasmids and transposons. Bacterial division at a population and cellular stage (growth curve). Bacterial metabolism: generalities, bacterial trophic types. Bases for the bacterial classification. Bacterial genetics.

Lesson 6.- General Bacteriology II.- Pathogenesis of bacterial infections. Antibacterial antibiotics: Mechanisms of action and drug resistance.

Lesson 7.- Gram-positive cocci.- Study of the biological characteristics, determinants of pathogenicity and pathogenic action of the Staphylococcus, Streptococcus and Enterococcus genera.

Lesson 8.- Gram-positive bacilli.- Study of the biological characteristics, determinants of pathogenicity and pathogenic action of the Corynebacterium, Listeria, Bacillus, Clostridium and Clostridioides genera.

Lesson 9.- Actinomycetales.- General biological characteristics and differentiation of Actinomycetales. Special study of the genus Mycobacterium. Other actinomycetales of medical concern: Actinomyces, Actinomadura, Nocardia and Streptomyces.

Lesson 10.- Gram-negative cocci and coccobacilli.- Study of the biological characteristics, determinants of pathogenicity and pathogenic action of Neisseria, Bordetella, Haemophilus, Legionella and Brucella.

Lesson 11.- Gram-negative bacilli I.- Study of the biological characteristics, determinants of pathogenicity and pathogenic action of species of the family Enterobacteriaceae.

Lesson 12.- Gram-negative bacilli II.- Study of the biological characteristics, determinants of pathogenicity and pathogenic action of species of the families Vibrionaceae and Aeromonadaceae.

## **3. SECTION II CONT: MEDICAL BACTERIOLOGY (11 lessons)**

Lesson 13.- Gram-negative bacilli III.- Study of the biological characteristics, determinants of pathogenicity and pathogenic action of the Pseudomonas, Burkholderia, Acinetobacter, Stenotrophomonas, Campylobacter, Helicobacter and Bacteroides genera.

Lesson 14.- Spirochaetales.- Study of the biological characteristics, determinants of pathogenicity and pathogenic action of the Treponema, Borrelia and Leptospira genera.

Lesson 15.- Rickettsiales, Mycoplasmatales and Chlamydiales.- Study of the biological characteristics, determinants of pathogenicity and pathogenic action of the genera Rickettsia, Coxiella, Ehrlichia and





Bartonella (Rickettsiales); Mycoplasma and Ureaplasma (Mycoplasmatales); Chlamydia and Chlamydophila (Chlamydiales).

#### **4. SECTION III: MEDICAL VIROLOGY (7 lessons)**

Lesson 16.- General Virology.- Virus classification. Viroids and prions. General structure and morphology of viruses: study of their different components. Viral replication: general stages and particularities of RNA and DNA viruses. Viral genetics. Pathogenesis of viral infections. Antivirals: mechanism of action.

Lesson 17. Order Herpesvirales. Family Herpesviridae: Alphaherpesvirinae subfamily: herpes simplex virus types 1 and 2, and varicella-zoster virus. Betaherpesvirinae subfamily: human cytomegalovirus and human herpes virus types 6 and 7. Gammaherpesvirinae subfamily: Epstein-Barr virus and human herpes virus type 8.

Lesson 18. Family Poxviridae. Family Adenoviridae: genus Mastadenovirus. Family Parvoviridae. Genera Parvovirus, Erythrovirus (parvovirus B19). Family Papillomaviridae: genus Papillomavirus. Family Polyomaviridae: genus Polyomavirus (JC virus and BK virus). Viral oncogenesis: oncogenes.

Lesson 19. Family Orthomyxoviridae: genus Influenzavirus: influenza viruses A, B and C. Order Mononegavirales: Family Paramyxoviridae. Subfamily Paramyxovirinae. Genus Respirovirus: parainfluenza viruses 1 and 3; genus Rubulavirus: parainfluenza viruses 2 and 4; mumps virus; genus Morbillivirus: measles virus. Subfamily Pneumovirinae: genus Pneumovirus: respiratory syncytial virus (RSV).

#### **5. SECTION III CONT: MEDICAL VIROLOGY (7 lessons)**

Lesson 20. Order Picornavirales. Family Picornaviridae: genus Enterovirus. Family Caliciviridae: genera Norovirus and Sapovirus. Family Astroviridae: genus Mamastrovirus. Family Reoviridae: genus Rotavirus. Family Matonaviridae: genus Rubivirus.

Lesson 21. Family Retroviridae: genus Lentivirus. Human immunodeficiency virus: HIV-1 and HIV-2. Genomic organization. Biological cycle. Antigenic structure: subtypes. Pathogenicity and AIDS natural history. Diagnosis, therapeutic bases and prophylaxis. Deltaretrovirus genre: Human T-Lymphotropic Virus (HTLV-I and HTLV-II).

Lesson 22. Hepatitis viruses. Genus Hepatovirus: hepatitis A virus. Family Hepeviridae: genus Orthohepevirus: hepatitis E virus. Family Hepadnaviridae: genus Orthohepadnavirus: hepatitis B virus. Family Kolmioviridae: genus Deltavirus: Delta virus. Family Flaviviridae: genus Hepacivirus: hepatitis C virus.



## **6. SECTION IV: MEDICAL MYCOLOGY AND PARASITOLOGY (8 lessons)**

Lesson 23.- General Mycology.- Morphofunctional characteristics of the fungi. Fungal organography. Asexual propagation and sexual reproduction. Bases of their classification. Pathogenesis of fungal infections. Antifungal drugs: mechanisms of action.

Lesson 24.- Medical Mycology I.- Study of the biological characteristics, determinants of pathogenicity and pathogenic action of the fungi producers of superficial, cutaneous and subcutaneous mycosis.

Lesson 25.- Medical Mycology II.- Study of the biological characteristics, determinants of pathogenicity and pathogenic action of the fungi producers of mucocutaneous mycosis, microsporidiosis, pneumocystosis, hyalomycosis and opportunistic and exotic faeohifomycosis.

Lesson 26.- General Parasitology.- Morphofunctional characteristics of the protozoa and metazoa of medical interest. Bases of their classification. Pathogenesis of parasitic diseases. Antiprotozoals and antihelmintics: mechanisms of actions.

Lesson 27.- Medical Protozoology I.- Study of the biological characteristics, determinants of pathogenicity and pathogenic action of the intestinal protozoa (*Entamoeba histolytica*, *Dientamoeba fragilis*, *Giardia duodenalis*, *Balantidium coli* and intestinal coccidia) and genitourinary (*Trichomonas vaginalis*). Medical interest of *Blastocystis* spp.

Lesson 28.- Medical Protozoology II.- Study of the biological characteristics, determinants of pathogenicity and pathogenic action of tissue protozoa (*Toxoplasma gondii*) and blood and tissue protozoa (*Leishmania* spp., *Trypanosoma* spp., *Plasmodium* spp.).

Lesson 29.- Medical Helminthology I.- Study of the biological characteristics, determinants of pathogenicity and pathogenic action of the species of phylum Platyhelminthes (cestodes, flukes and schistosomes) of medical interest.

Lesson 30.- Medical Helminthology II.- Study of the biological characteristics, determinants of pathogenicity and pathogenic action of the species of phylum Nematoda.

## **7. SEMINAR PRACTICES (3 seminars of 2 hours and 5 seminars of 1 hour)**

Attendance is compulsory.

- 1.- Pathogenic models of the bacterial infections. (2 hours)
- 2.- Antimicrobials: general concepts and classification. Mechanisms of resistance. (2 hours)
- 3.- Practical aspects of the microbiological diagnosis of infectious diseases: Diagnosis and epidemiological application of molecular methods. (2 hours)
- 4.- Pathogenesis of viral infections. (1 hour)
- 5.- Exotic and emerging viral infections. (1 hour)
- 6.- Endemic and emerging mycosis. (1 hour)
- 7.- Medical phycology: *Prototheca* sp. and dinoflagellates. Medical interest of *Rhinosporidium seeberi*



and of free-living amoeba. Filariasis: importance of vector transmission (1 hour)

8.- Medical entomology. (1 hour)

## **8. TUTORIALS (4 hours)**

The main goal of the tutorial sessions is to guide the study and the resolution of the arising doubts. Thus, the active participation of the students is required in order to facilitate the communication with the teachers and the setting of specific conceptual difficulties and their solution.

Different sessions will be held in each theory group, which will take place on the days agreed between the responsible teachers and the students of the corresponding groups. Attendance is optional and is a non-evaluable activity.

## **9. LABORATORY PRACTICES (3 sessions of 2 hours)**

Session 1.- Introduction to the Medical Microbiology laboratory and its working methods. Explanation of the basic safety rules, the handling of basic instruments and the aseptic techniques.- Microscopic examination: procedures and observation of microorganisms by means of wet mounts, simple stains and / or differential stains. Gram's stain.- Cultures: types of microbial culture and colonies isolation by streaking solid culture media.- Study of human saprophytic microbiota: examples of inoculating pharyngeal exudate and/or fingerprint smear in culture media.

Session 2.- Medical bacteriology I. Gram stain and observation of different bacterial morphotypes.- Reading and interpretation of the results of the pharyngeal exudate and / or culture of the skin smear.- Introduction to the study of biochemical characteristics in bacterial diagnosis (I): rapid identification tests: catalase and oxidase. Study of biochemical characteristics in bacterial diagnosis (II): explanation and observations of biochemical identification tests according to the metabolic characteristics of different groups of bacteria.

Session 3.- Medical bacteriology II. General explanation of antimicrobial susceptibility testing (disc-plate diffusion methods, determination of MICs by Epsilon diffusion and / or dilution methods). To perform an antibiotic sensitivity test (antibiogram) by disc-plate diffusion (Kirby-Bauer technique).

## **10. LABORATORY PRACTICES (3 sessions of 2 hours)**

Session 5.- Medical Mycology: explanation and macroscopic and microscopic observation of the structure and morphology of different yeast and filamentous fungi: fresh microscopic examination and / or calcofluor White staining. - Explanation and description of identification methods in medical mycology: observation of early filamentation test and negative staining of capsules.

Session 6.- Medical Parasitology: protozoa, helminths and arthropods. Explanation and macroscopic and microscopic observations of adults and helminth eggs.- Explanation and microscopic observation of hematic, tissue and intestinal protozoa.- Basic explanation and macroscopic and microscopic observations of arthropods. Observation of clinical samples for parasitological diagnosis.

**WORKLOAD**

ACTIVITY	Hours	% To be attended
Theory classes	33,00	100
Laboratory practices	12,00	100
Seminars	11,00	100
Tutorials	4,00	100
Study and independent work	45,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	10,00	0
Preparing lectures	10,00	0
Preparation of practical classes and problem	20,00	0
<b>TOTAL</b>	<b>150,00</b>	

**TEACHING METHODOLOGY**

The attendance hours (theoretical lessons, practices and seminars) will be the 40% of the hours of one ECTS credit, while the 60% of the remaining hours will be focused on the study and autonomous work, individual or in group, by the student.

Thus, in this subject the cognitive content (theoretical lessons, seminars, participation in tutored groups and study by the student himself) with procedural content (practices) will be combined.

In the **theoretical lessons** (30 hours of lessons), the teacher will expose by a master class, the content, methods and procedures to obtain the knowledge and the skills that the students must acquire. With the aim of making the lessons dynamic and trigger the students' participation, they can download the didactic material used by the teacher in the development of each topic from the Aula Virtual.

In the **seminars** (11 hours with 3 seminars of 2 hours and 5 seminars of 1 hour), specific topics will be discussed that will be useful for the students' continuous assessment. For each seminar, the didactic materials and the appropriate bibliography for the preparation will be given to the students.

In the **tutorials** (4 hours), small groups of students will set questions and discuss about the topics proposed by the teacher, previously prepared and developed by the student.

In the **laboratory practices** (12 hours, 6 sessions of 2 hours), the students, distributed in small groups, will fulfill and discuss essential activities of the microbiological diagnosis, previously explained by the teacher. The monitoring of these activities will be made, by the teacher, through the continuous assessment of the compulsory attendance and the student's appropriate degree of participation.





## EVALUATION

In the evaluation of the students' learning, the acquired knowledge of both the cognitive and procedural contents, in which this matter is organized, will be valued, by means of the corresponding theoretical and practical exams, respectively.

The mark corresponding to the theoretical exam represents 60% (6 points) of the final maximum mark, and the one corresponding to the practical the remaining 40% (4 points). It is necessary to pass both types of tests (theoretical exam  $\geq 3$  points and practical exam  $\geq 2$  points) to obtain the marks of: Pass,  $\geq 5$  points; Notable,  $\geq 7$  points; Excellent,  $\geq 9$  points; With highest honours, among the best excellent.

A.- The theoretical exam (6 points) is carried out through an exercise consisting of 60 multiple-choice questions with a single correct answer and for every four wrong answers the value of a correct answer will be subtracted. Maximum score: six (6) points; Minimum qualification necessary to be added with the one obtained in the practical part:  $\geq 3$  points (PASS).

The PASS grade obtained in the first call, in case of not passing the practical exam, will be kept until the second call of the same academic year.

B.- The practical exam (subject of Seminars and laboratory practices) (4 points) is carried out through an exercise composed of 40 multiple-choice questions with a single correct answer and for every four wrong answers the value of a correct answer will be subtracted. Maximum score: four (4) points; Minimum qualification necessary to be added with the one obtained in the theoretical part:  $\geq 2$  points (APTO).

The PASS grade obtained in the first call, in case of not passing the theoretical exam, will be kept until the second call of the same academic year.

Attendance to practical sessions is mandatory. In case of not passing the subject, attendance will be kept for the next year. Unjustified non-attendance to more than 20% of the sessions will make it impossible to pass the course.

Students are reminded of the importance of carrying out evaluation surveys on all the teaching staff of the degree subjects.

## REFERENCES

### Basic

- Murray PR, Rosenthal KS y Pfaller MA. (2021). Microbiología médica 9ª ed. Elsevier España SL. ISBN 9788491138082
- Prats Pastor, G. (2013). Microbiología y parasitología médicas. Editorial Médica Panamericana SA. Madrid. ISBN 9788491106111



- Ryan KJ, Ray CG. (2017). Sherris Microbiología Médica. 7ª ed. Editorial McGraw Hill. ISBN 9781264268719
- Recursos-e Salut: ClinicalKey Student. Elsevier (Scopus, ScienceDirect)  
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#### **Additional**

- Bennett JE, Dolin R y Blaser MJ. (2020) Mandell, Douglas y Bennett. Enfermedades Infecciosas. Principios y Práctica 9ª ed. Elsevier España SL. Vol I. ISBN 9780443065811
- García Sánchez JE, López R y Prieto J eds. (1999). Sociedad Española de Quimioterapia. Antimicrobianos en Medicina. Prous Science. ISBN 84-8124-167-9
- Carroll KC et al. Manual of Clinical Microbiology (2019). 12th Edition. ASM Press. Washington DC. ISBN 978-1-555-81983-5