COURSE DATA

Data Subject	
Code	34700
Name	Microbiology and immunology
Cycle	Grade
ECTS Credits	6.0
Academic year	2024 - 2025

Study (s)

Degree	Center	Acad. year	Period
1206 - Degree in Dentistry	Faculty of Medicine and Odontology	1	First term

Subject-matter

Degree	Subject-matter	Character
1206 - Degree in Dentistry	5 - Microbiology and immunology	Basic Training

Coordination

Name	Department
BUESA GOMEZ, FRANCISCO JAVIER T	275 - Microbiology and Ecology
MUÑOZ COLLADO, CARLOS	275 - Microbiology and Ecology

SUMMARY

Microbiology and Immunology is taught in a semester during the first course. It is a core subject that studies microorganisms acting as infectious agents of humans, and the mechanisms of protection, both nonspecific and specific, that defend the human body against infections. A special emphasis is made on the study of the microbiota of the mouth and on the microbiology of oral infections, as well as on the microbiological basis of the control of infections and of antimicrobial therapy.
Students acquire the conceptual bases of the role of microorganisms in health and diseases of the oral cavity. Their analysis establishes relationships with other core subjects of the Degree in Dentistry, like Biology and Biochemistry, and provides expertise on diagnosis, pathogenesis and therapy of infectious disease, which will be studied in various subjects: Pathology and general medical Pediatrics, Oral manifestations of systemic diseases, Oral Medicine, Pathology and Periodontics

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

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

1206 - Degree in Dentistry

- Saber utilizar y valorar críticamente las fuentes de información científica y biomédica para obtener, interpretar y comunicar la información clínica. Entender las aplicaciones y limitaciones de las tecnologías de la información. Usar correctamente sistemas de base de datos para garantizar la investigación y la actualización profesional.
- Saber utilizar las tecnologías de la información y de la comunicación en las actividades clínicas, terapéuticas, preventivas y de investigación. Conocer la Ley de Protección de Datos, la confidencialidad de la información de los pacientes y los límites de la divulgación de datos médicos.
- Desarrollar una visión crítica y creativa en la actividad profesional, con escepticismo constructivo y orientado a la investigación.
- Understand the importance and the limitations of scientific thinking in the study, prevention and management of diseases.
- Tener capacidad de formular hipótesis, hallar y evaluar la información necesaria para la resolución de problemas de asistencia bucodental, conforme al método científico.
- Acquire basic training for research.
- Comprender los elementos que intervienen en la gestión sanitaria, los condicionantes económicos y sociales, teniendo capacidad para analizar sus implicaciones en la práctica odontológica.
- Reconocer las limitaciones propias y la necesidad de mantener y actualizar su competencia profesional, de modo especial mediante el aprendizaje autónomo de nuevos conocimientos y técnicas.
- Conocer y comprender la estructura y características de los diferentes tipos de microorganismos que componen la flora de la cavidad oral.
- Conocer las características microbiológicas de los patógenos responsables de las infecciones bucodentales más frecuentes.
- Comprender los principales mecanismos de transmisión colonización y patogenia de los microorganismos implicados en las enfermedades orales.
- Conocer los procedimientos y pruebas de diagnóstico microbiológico, conocer su utilidad clínica y adquirir la capacidad de interpretar sus resultados.

- Conocer y comprender el papel de patógenos sistémicos en el desarrollo de enfermedad oral y su capacidad de transmisión durante la práctica clínica.
- Conocer los mecanismos de respuesta inmunitaria frente a la infección y las repercusiones de los procesos de inmunodeficiencia en el desarrollo de enfermedades bucodentales.
- Conocer los procedimientos de control de la infección oral mediante el uso adecuado de antisépticos y antimicrobianos.
- Conocer y comprender los avances en investigación de patología infecciosa oral.

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

English version is not available

DESCRIPTION OF CONTENTS

1. THEORY THEMATIC UNITS

1.- Microbiology. Historical evolution. Differences between prokaryotic and eukaryotic cellular organization. Kingdoms of nature and situation of human pathogenic microorganisms. Concepts of Medical Microbiology and Oral Microbiology.

2.- Host-parasite relationship.- Types of relationships. Normal human microbiota. Colonization versus infection. Koch's postulates. Pathogenicity and virulence. Factors responsible for pathogenicity.

3.- Control of microbial life.- Antimicrobials: general concepts, classification. Disinfection and sterilization. Physical agents: types, mechanism of action and control measures. Chemical agents: types, mechanism of action and control measures.

4.- General virology.- Classification of viruses. Viroids and prions. Morphology and general structure of viruses: study of the different components. Multiplication of viruses: general phases and particularities of RNA and DNA viruses. Pathogenesis of viral infections. Antivirals: mechanism of action.

5.- General bacteriology I.- Morphology, grouping and staining affinity of bacteria. Bacterial structures: external, superficial and internal. Composition and function of the external structures: capsule, flagella and pili. Composition and function of surface structures: cell wall and cytoplasmic membrane. Cell wall: biosynthesis and differences between gram-positive and gram-negative bacteria.

6.- General bacteriology II.- Composition and function of the internal bacterial structures: ribosomes, inclusions, nucleus and spores. Plasmids and transposons. Bacterial division at the cellular and population level (curve of growth). Bacterial metabolism: generalities, trophic types of bacteria. Bases for the classification of bacteria.

2. THEORY THEMATIC UNITS

7.- General bacteriology III.- Pathogenesis of bacterial infections. Antibacterial antibiotics: mechanism of action and resistance phenomena.

8.- Bacterial genetics.- Phenotypic and genotypic variations. Mutations: mutagenesis and its phenotypic expression. Gene transfer and recombination phenomena: restriction-modification systems. Study of the phenomena of transformation, conjugation and transduction.

9.- General mycology.- Morphofunctional characteristics of fungi. Fungal organography. Asexual propagation and sexual reproduction. Bases of its classification. Pathogenesis of fungal infections. Antifungals: mechanism of action.

10.- General protozoology.- Morphofunctional characteristics of protozoa. Bases of their classification. Pathogenesis of protozooses. Antiprotozoa: mechanism of action.

11.- Introduction to Immunology.- Historical evolution and basic concepts. Immune response: cells and organs involved. First theories: humoral and cellular theory. Ehrlich's theory of antibody formation. Selective, instructive and clonal selection theories.

12.- Antigens and immunogens.- Concept of antigenicity and immunogenicity. Types of antigens. Haptens. Antigenic determinants. Antigenic variability.

13.- Immunoglobulins.- Classes of immunoglobulins. Constant and variable regions. Three-dimensional structure of immunoglobulins. Biological functions. Allotype: concept and classes. Idiotype: concept.

14.- Innate immunity. Pattern recognition receptors. Complement system.- Concept. Molecular mechanisms of activation by the classical, alternative and lectin pathways. Biological functions and regulation of the complement system. Cellular receptors for complement.

15.- Major histocompatibility complex (CMH) .- Concept. Immunogenetics of the HLA system. MHC class I, II and III genes. Physiological importance.

3.

16.- Antigen-antibody reaction and cell interactions.- Primary epitope-antibody interaction. Affinity: concept, determination and physiological importance. Recognition of antigens by T and B cells. T-B cooperation for the production of antibodies. Mechanism of cytotoxicity: cell-mediated cytotoxicity and antibody-mediated cytotoxicity.

17.- Regulation of the immune response.- Concept. Regulation by antibodies. Idiotypic regulation. Interleukins (cytokines): concept, biological functions and modulation. Regulation by T cells.

18.- Immunology of infections.- Immunological aspects of viral, bacterial, fungal and parasitic infections. Effector and survival mechanisms of the parasite.

19.- Bacteriology I.- Study of gram-positive coccoid bacteria of dental interest. Special study of Streptococcus mutans.

20.- Bacteriology II.- Study of the genera Haemophilus, Aggregatibacter, Capnocytophga, Cardiobacterium and Eikenella.

21.- Bacteriology III.- Study of gram-negative anaerobic bacteria.

22.- Bacteriology IV.- Study of gram-positive anaerobic bacteria. Study of Actinomycetales and Spirochaetales of interest in Dentistry.

23.- Virology I.- Study of DNA and RNA viruses of oral interest.

24.- Virology II.- Study of the hepatitis viruses and the human immunodeficiency virus.

25.- Mycology and Protozoology- Study of Candida albicans and other fungi of oral concern. Study of Entamoeba gingivalis, Trichomonas tenax and Leishmania spp. and their oral interest.

26.- Ecology and oral microbiota.- Oral ecosystems: ecological characteristics and determinants. Nature of the oral microbiota: primary ecosystems, succession of the oral microbiota.

27.- Microbiology of dental plaques.- Microbial composition and biochemical aspects of dental plaques. Microbiological bases for its control.

4. THEORY THEMATIC UNITS

28.- Microbiology of dental caries.- Basic concepts and importance of caries. Etiopathogenesis of caries. Control of dental caries.

29.- Periodontal and peri-implant microbiology.- Concept and classification of periodontal diseases. Gingivitis: etiopathogenesis and clinical forms. Periodontitis: etiopathogenesis, clinical forms and complications. Microbiological aspects of dental implants.

30.- Microbiology of endodontic disease and related processes.- Basic concepts. Pulpitis: clinical forms and etiopathogenesis of vital pulp and necrotic pulp infections. Periapical reaction: etiopathogenesis of apical periodontitis and its complications.

5. 2. SEMINARS (7 seminars of 2 hours)

Seminar 1.- Pathogenesis of bacterial infections.
Seminar 2.- Pathogenesis of viral and fungal infections.
Seminar 3.- Mechanisms of action of antimicrobials.
Seminar 4.- Mechanisms of resistance of microorganisms against antimicrobials.
Seminar 5.- Microbiological diagnosis of dental and oral infections.

Seminar 6.- Immune response against infectious agents.
Seminar 7.- Systemic manifestations of oral infections and oral manifestations of systemic infections.

6. PRACTICES (4 practical sessions of 2.5 hours and 1 session of 2 hours)

Session 1.- Biological safety and security in the Microbiology laboratory. Description and use of the microbiological material. Concept of aseptic technique. Culture and isolation of microorganisms in solid media. Collection and inoculation of samples with human microbiota. Snyder's test: inoculation. Performance and microscopic observation of simple stains.

Session 2.- Observation of the cultures on solid media inoculated on the first day and performance of the corresponding morphological descriptions. Snyder test: reading. Performance and observation of smears with different bacterial morphotypes stained by the Gram method.

Session 3.- Characterization and phenotypic identification of bacteria: preliminary tests (catalase, oxidase) and performance of a set of biochemical tests. Antimicrobial susceptibility testing: a) Antibiogram performance; b) Reading and interpretation of the Epsilon-test.

Session 4.- Reading and interpretation of the biochemical bacterial identification tests. Reading and interpretation of antimicrobial susceptibility tests. Ziehl-Neelsen staining and observation of acid-fast bacilli.

Session 5.- Culture and identification of fungi: macroscopic and microscopic observation of filamentous fungi and yeast cultures. Performance of diagnostic tests in Mycology: early filamentation test and calcofluor white staining. Microscopic observation of trophozoites and protozoan cysts. Final evaluation test of the laboratory practices.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	33,00	100
Classroom practices	15,00	100
Laboratory practices	12,00	100
Development of group work	5,00	0
Study and independent work	60,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	10,00	0
Preparing lectures	5,00	0
Preparation of practical classes and problem	5,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

A syllabus of 30 theoretical classes is developed, using the master lesson method, motivating student intervention. There are 6 seminars lasting 2 hours, with active participation of the students, which present topics related to the subject that they have previously discussed and prepared in groups of 5 students. 12 hours of practices are taught in the Microbiology laboratory, with individual work and group analysis of the results.

The gender perspective, respect for diversity and the sustainable development goals (SDGs) will be incorporated into teaching, whenever possible.

EVALUATION

a.- The contents of the theory programme are assessed by means of an examination consisting of: 1) 5 questions to be answered in writing; each correct question is worth 0.6 points, and 2) 30 multiple-choice questions ("test") with 4 possible answers and only one of them correct; each correct question is worth 0.1 points and each wrong question deducts 0.025 points. The evaluation obtained in this theory section constitutes 60% of the final mark.

b.- Practical work: a final test of multiple-choice questions is performed, in which the skills and abilities acquired in the practical classes are assessed. The evaluation obtained in this section constitutes 20% of the final mark.

c.- Seminars: the student's participation in the seminars is assessed, constituting 20% of the overall grade for the subject.

It is required that in each of the partial evaluations (a, b, c) 50% of the maximum possible grade is exceeded in order for the total evaluation of the subject to be assessed.

Attendance at practical activities is mandatory. The student is considered to meet this requirement if he or she has attended a minimum of 80% of these activities and has adequately justified the impossibility of attending the remaining sessions due to the occurrence of a cause of force majeure. It will be essential to comply with this requirement to pass the subject.

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

REFERENCES

Basic

- Liébana Ureña J. (2002). Microbiología oral. 2ª ed. McGraw-Hill Interamericana. ISBN 9788448604608.

- Murray PR, Rosenthal KS y Pfaller MA. (2021). Microbiología médica 9ª ed. Elsevier España SL. ISBN 9788491138082.
- Levinson, W. (2006). Microbiología e inmunología médicas. 8ª ed. McGraw-Hill Interamericana. ISBN 9788448145408.
- De la Rosa, V., Prieto, J., Navarro, J.M. (2011). Microbiología en ciencias de la salud: conceptos y aplicaciones. 3ª ed. Elsevier. ISBN 9788480866927.
- RECURSOS e-Salut:
  -ClinicalKey Student Medicina, Odontologia y Enfermería
  [https://uv-es.libguides.com/RecursosSalut]
  -Acces Medicina
  [https://uv-es.libguides.com/Access_Medicina]
  -Médica Panamericana
  [https://uv-es.libguides.com/Medica_Panamericana]

Additional

- Lamont, R.J., Hajishengallis, G.N., Koo, H. & Jenkinson, H.F. (2019). Oral Microbiology and Immunology, 3rd ed. American Society for Microbiology, Washington, DC. ISBN 978-1-55581-998-9.
- Samaranayake, L. (2018). Essential Microbiology for Dentistry, 5th ed. Elsevier Ltd. ISBN 9780702074356.
- Delves, P.J., Martin, S.J., Burton, D.R. & Roitt. I.M. (2017). Roitts Essential Immunology, 13th ed. John Wiley and Sons, Ltd. ISBN 9781118415771.
- Fainboim, L., Geffner, J. (2011). Introducción a la inmunología humana. 6ª ed. Editorial Médica Panamericana, 2011. ISBN 9789500602709.