COURSE DATA

Data Subject	
Code	34287
Name	Ocular biology
Cycle	Grade
ECTS Credits	6.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1207 - Degree in Optics and Optometry	Faculty of Physics	1	First term

Subject-matter

Degree	Subject-matter	Character
1207 - Degree in Optics and Optometry	3 - Biology	Basic Training

Coordination

Name	Department
ALBEROLA ENGUIDANOS, JUAN ANTONIO	275 - Microbiology and Ecology
MATEO JIMENEZ, EVA MARIA	275 - Microbiology and Ecology
NAVARRO MARZAL, ALFONSO LUIS	30 - Biochemistry and Molecular Biology

SUMMARY

The subject has the general objective of providing the student of Optics and Optometry with the concepts, competences and skills that allow him to understand the basic aspects of the microbial world and its importance in infectious human ocular pathology, forming it so that in the future it constitutes an effective first line of defense of the sanitary system as far as health and ocular hygiene are concerned.

The specific objectives to be achieved are:

- Know and understand the main functional characteristics (structural, genetic, physiological) of infectious agents involved in ocular pathology.

- Understand the pathogenic mechanisms of eye tissues and the responsesimmune causing.- Know and understand the microbiological diagnostic procedures and the basesof the etiological treatment of infectious diseases that affect the apparatushuman eyepiece.

- Train the student in basic microbiological techniques: aseptic technique,culture of microorganisms, sterilization procedures, hygiene and control ofmicrobial world.

- Provide the conceptual bases and the necessary methodological skillsto advise, instruct and control patients regarding the risks and prevention of eye infections, especially in contact lens wearers.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

Although there are no specific prerequisites, it is recommended that the student have a basic knowledge of Life Sciences and express a clear interest in Health Sciences and in clinical and healthcare work, as well as the ability to study topics related to high transversality

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

1207 - Degree in Optics and Optometry

- Knowing how to apply the knowledge acquired to professional activity, knowing how to solve problems and develop and defend arguments.
- Being able to gather and interpret relevant data to make judgments.
- Being able to transmit information, ideas, problems and solutions to both a specialized and non-specialized audience.
- Development of learning skills necessary to undertake further studies with a high degree of autonomy.
- To know the cell structure, embryonic development and organogenesis.
- To determine the development of the visual system.
- To recognize with macroscopic and microscopic methods the morphology and structure of tissues, organs and systems of the human body.
- To know the different microorganisms involved in diseases of the visual system.
- To know the principles and bases of the biological processes involved in the normal functioning of the visual system.
- To know the composition and structure of the molecules that make up living beings.
- To apply biochemical knowledge to the eye and the vision process.
- Knowledge of the structure and function of animal cells and tissues as well as systems related to the visual system.

- Ability to identify the different areas of the visual organ under the microscope.
- To understand the transformations of some biomolecules in others.
- To study the molecular bases of the storage and expression of biological information.

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

The consequence of acquiring the skills described above will be reflected in a series of professional skills, abilities and aptitudes that will make the student self-sufficient to:

• Advise, instruct and monitor patients regarding the maintenance of good eye hygiene and the risks and prevention of eye infections

• Act as a primary care agent in ocular health and hygiene with the clinical ability necessary for the examination and detection of infectious processes in patients.

• Develop reasoning and theoretical and practical arguments about the role of microorganisms as the source of eye infections.

• Understand and incorporate into your professional practice the future advances and developments that are taking place in the field of Ocular Microbiology.

• Participate in the design and implementation of experimental research projects related to Ocular Microbiology.

DESCRIPTION OF CONTENTS

1. LESSON 1.- Fundamental concepts about infectious diseases.

Health and disease. Infectious diseases: etiological diversity. Sequence and establishment of an infection or disease. Transmission and epidemiology: basic concepts. Nosocomial infections. Re-emerging and emerging diseases.

2. LESSON 2.- Infectious pathology

Introduction to the pathogenesis of infectious diseases. Pathogenicity, virulence. Types of microorganisms and their mechanisms of pathogenicity. Clinical expression of infections.

3. LESSON 3.- Ocular semiology.

Introduction to ocular biology. Eyes and ocular annexes. Semiology of the ocular apparatus and its annexes. Exploration of the ocular apparatus. Ophthalmologic clinical semiology: signs and symptoms.

4. LESSON 4.- Introduction to Medical Microbiology.

Concept of Microbiology. Generalities and history of Microbiology. Concept of microorganism. Importance of the microbial world. Classification of microorganisms. Theory of infectious disease. Contributions of the schools of Pasteur and Koch. Discovery of ocular infections. Molecular Microbiology and the Tree of Life. Applications of Microbiology for an Optometrist.

5. LESSON 5.- Microbial morphology and structure.

Anatomy of the prokaryotic cell. Anatomy of the eukaryotic cell. Study of the analogies and differences between the structure of prokaryotic and eukaryotic microorganisms. Microbial systematics, taxonomy and nomenclature.

6. LESSON 6.- Bacterial genetics.

Bacteria: genetic material and cell division. Bases of microbial genetics. Mutation, mutagenesis and mutants. Effects of mutation on phenotype. Processes of genetic recombination. Transformation. Transduction. Bacterial conjugation. Extrachromosomal genetic elements. Microbial genomics and metagenomics.

7. LESSON 7.- Microbial metabolism and physiology

Chemical composition and nutritional requirements of microorganisms. Growth factors. Physicochemical factors affecting microbial development: oxygen, temperature, pH, osmotic pressure, redox potential. Culture of aerobic and anaerobic microorganisms. Microbial growth curve.

8. LESSON 8.- Introduction to Virology

Nature of viruses. Characteristics of the viral particle. Life cycle of viruses. Effects of viral multiplication in the host cell. Methods of culture and identification. Classification of animal viruses. Pathogenesis of viral infections. Concepts of viroids and prions.

9. LESSON 9.- Introduction to Medical Mycology

Morphological, structural and biological characteristics of fungi. Fungal growth and reproduction. Classification of fungi. Classification of mycoses. Pathogenesis of fungal infections.

10. LESSON 10.-Introduction to Medical Parasitology

Classification of human parasites. Parasite-host relationship. Basic concepts about protozoa, helminths and arthropods. Parasites of the human ocular apparatus.

11. LESSON 11.- Microbial symbiosis with the human being

Human microbiota. Study of the microbiota of the healthy eye. Form of acquisition and variability of the ocular microbiota. Transmission of ocular infections. Formation of deposits on the surface of contact lenses. Adherence of microorganisms to contact lenses. Growth of microorganisms in the contact lens matrix.

12. LESSON 12.- Introduction to Immunology

Basic concepts about the defense mechanisms against infection. Cells and organs of the immune system. General concepts and basic mechanisms of natural immunity and specific immunity. Inflammation. Phagocytosis. Complement system. Antibodies: structure, types, production. Immunity and immunization.

13. LESSON 13.- Microbiological diagnostic protocols of ocular infections I

Fundamentals of microbiological diagnosis. Classification of microbiological diagnostic methods. Direct diagnosis: Collection, transport, preservation and processing of samples. Conjunctival exudate. Palpebral exudate. Samples from the lacrimal apparatus. Contact lenses.

14. LESSON 14.- Microbiological diagnostic protocols for ocular infections II

Culture and isolation of microorganisms: types of media. Identification and quantification of microorganisms. Antimicrobial susceptibility studies. Rapid diagnostic methods and ocular infections. Criteria for the interpretation of results.

15. LESSON 15.- Microbiological diagnostic protocols for ocular infections III

Serological diagnosis: Conceptual bases. General indications. Most frequently used methods. Advantages and disadvantages. Sensitivity and specificity concepts.

16. LESSON 16.- Ocular infections caused by Gram-positive bacteria

Study of the microbiological characteristics, ocular manifestations, prevention and treatment of infections caused by Gram-positive bacteria. Ocular infections caused by Staphylococcus spp. and Streptococcus spp.

17. LESSON 17.- Ocular infections caused by Gram-negative bacteria

Study of the microbiological characteristics, ocular manifestations, prevention and treatment of infections caused by Gram-negative bacteria: ocular infections caused by Neisseria spp, Haemophilus spp, Enterobacteriaceae, Pseudomonas spp. and Moraxella catarrhalis.

18. LESSON 18.- Ocular infections caused by intracellular bacteria and spirochetes

Ocular infections caused by Chlamydia trachomatis. Study of trachoma. Inclusion conjunctivitis and other ocular manifestations. Prevention and treatment. Ocular infections caused by mycobacteria. Ocular infections caused by spirochetes: Treponema pallidum, Leptospira spp.

19. LESSON 19.- Ocular infections caused by viruses with DNA genomes

General characteristics of the Herpesviridae family. Etiopathogenesis, diagnosis and treatment of the subfamily Alphaherpesvirinae: Herpes simplex virus and varicella-zoster virus. Etiopathogenesis, diagnosis and treatment of the Betaherpesvirinae subfamily: Cytomegalovirus, human herpesvirus 6 and human herpesvirus 7. General characteristics of Adenoviruses. Etiopathogenesis, diagnosis, control and prevention of Adenovirus infections.

20. LESSON 20.- Ocular infections caused by viruses with RNA genomes

Etiopathogenesis, diagnosis, treatment and prophylaxis of influenza viruses. Etiopathogenesis, diagnosis and prophylaxis of measles virus and mumps virus. Etiopathogenesis and diagnosis of enteroviruses of interest in ophthalmology: enterovirus 70 and coxsackievirus A24. General characteristics of retroviruses. Etiopathogenesis, diagnosis and therapeutic basis of human immunodeficiency virus.

21. LESSON 21.- Fungi as etiological agents producing ocular infections

Characteristics of ocular mycoses. Study of the main genera involved in ocular mycosis of exogenous origin: Aspergillus, Penicillium, Candida, Sporothrix, Alternaria. Study of the main genera involved in ocular mycoses of endogenous origin: Histoplasma, Cryptococcus, Blastomyces, Coccidioides, and Zygomycosis. Study of the main etiological agents involved in ocular mycosis of atypical etiology: Pneumocystis jirovecii, Rhinosporidium seeberi.

22. LESSON 22.- Main parasites of the human ocular apparatus

Study of the main ocular parasitosis caused by protozoa: Acanthamoeba, Toxoplasma gondii. Study of the main ocular parasitosis caused by helminths: Toxocara spp, Onchocerca volvulus, Loa loa, Taenia solium, Thelazia spp. and Echinococcus granulosus. Study of the main ocular parasitosis caused by arthropods: Demodex spp., Pthirus pubis and ocular myiasis.

23. Content of the Seminar Sessions (9 hours)

24. Seminar 1: Control of microorganisms

Basic concepts: sterilization, disinfection, antisepsis. Physical methods of control. Temperature action. Moist heat. Filtration method. Ultraviolet radiation and ultrasound. Use in Optics and Optometry.

25. Seminar 2:

Chemical methods of control. Evaluation of a disinfectant. Biological methods of control.

26. Seminar 3:

Cleaning, disinfection and sterilization products in contact lenses. Microbiological study of ophthalmic preparations. Microorganisms that most frequently contaminate contact lens maintenance fluids.

27. Seminar 4:

Study of the main antibacterial agents. Use in the treatment of ocular infections.

28. Seminar 5:

Study of the main antifungal and antiviral agents. Use in the treatment of ocular infections.

29. Seminar 6:

Evaluation of antimicrobial activity. Antimicrobial susceptibility testing.

30. Seminar 7:

Basis of resistance to antimicrobial agents. Resistance mechanisms and repercussions.

31. Seminars 8 and 9:

Approach, resolution and discussion of different clinical cases of ocular infectious pathology.

32. Content of the Laboratory Sessions (5 hours)

33. Practical Laboratory Session 1:

General rules of the Microbiology laboratory. Description and use of the optical microscope. Sterilization procedures and aseptic technique. Sample collection. Culture of microorganisms. Environmental contamination. Isolation of microorganisms in axenic culture. Observation of cultures of clinical samples and different bacterial morphotypes. Microbiological analysis of ocular exudates. Staining procedures: Simple staining, Gram staining.

34. Practical Laboratory Session 2:

Characterization and phenotypic identification of bacteria: preliminary tests and biochemical tests. Identification using miniaturized systems. Procedures for determination of antimicrobial susceptibility. Performance of an antibiogram by the Kirby-Bauer technique. Assessment of the intrinsic inhibitory power of contact lens care fluids.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	45,00	100
Tutorials	10,00	100
Laboratory practices	5,00	100
Development of individual work	3,00	0
Study and independent work	40,00	0
Readings supplementary material	10,00	0
Preparation of evaluation activities	15,00	0
Preparing lectures	11,00	0
Preparation of practical classes and problem	6,00	0
Resolution of online questionnaires	5,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

The didactic methodology proposes a strategy of interaction with the student at multiple levels, combining the following procedures and techniques:
- Theoretical Classes (either face-to-face, ie Master, virtual (ie by video conference)) (40 hours): Formal presentation by the Professor of each of the subjects of the Subject Theory Program, having been made available to the student and prior to class, a collection of teaching material (the computer presentation, a document describing where to find each topic among the recommended bibliography, a document containing the recommended readings, scientific articles, videos, or web pages for each topic, a self-assessment questionnaire on the topic, similar to the final exam, without the answers, the answers to the questionnaire on the previous topic, a document with exam questions on the previous topics prepared by the students and reviewed by the teacher).
- Seminars (9 hours): Based on the topics presented, a group discussion about certain issues, facts, problems, situations, clinical cases, etc. will be considered in those cases that allow it.

- Laboratory Sessions (5 hours): Distributed in two Sessions of 2.5 hours each, and starting from a Laboratory Manual previously distributed to the students, they will carry out, after the explanation and practical demonstration carried out by the Professor, various exercises , methodologies, diagnostic procedures and observations related to the content of the subject. At the end of the laboratory sessions, the student must submit a report of their observations and results.
- Tutoring and Continuous Assessment Sessions (6 hours): Distributed in six Sessions of 1 hour each, where doubts or clarifications are resolved by the students and they answer a questionnaire, on groups of 3-4 topics of the Theory Program of the subject.

EVALUATION

In the evaluation system, for the calculation of the student's final grade, the Theory part represents 60% and the Practical part (Seminars and Laboratory Sessions) 40%. Thus, to evaluate the student's learning, the three parts of the Subject will be graded as described below:

- The qualification of the Theory part is the result of an exam taken at the end of the course of all subjects. The minimum grade to pass this part is 5.0. To inform and assess the progress of the student, recoverable continuous assessment activities will be carried out whose results will be combined with the final test.

- For the qualification of the Seminars, the result of an examination of all the Seminars carried out at the end of the course will be taken. The minimum grade to pass this part is 5.0.

- The qualification of the Laboratory Sessions will be the result of an examination carried out at the end of them. For this part, the Teacher modulates the grade individually based on the student's participation throughout the Laboratory Sessions, and their Laboratory Memory. The minimum grade to pass this part is 5.0.

- For the calculation of the grade of the Practical Part of the Subject (Seminars plus the Laboratory Sessions) the grade obtained in the Seminars represents 66.66% and the grade of the Laboratory Sessions the remaining 33.34%.

All exams, whether those of the Theory part, the Seminars or the Laboratory Sessions, will consist of multiple choice questions, development questions of different complexity and / or questions of concise, succinct or exact answer. In the case of the Final Exam, the Theory part will consist of two exercises, each of them on 11 topics. The Final Exam of the Seminars will contain between 20 and 30 questions.

Attendance at the Sessions, both Seminars and Laboratory Practices (which will be held in the Practice Room of the Departmental Section of Microbiology of the Faculty of Medicine and Dentistry) is mandatory and, therefore, *conditio sine qua non* to pass the Course

REFERENCES

Basic

- Microbiología Médica, 8a edición (2017) Patrick R. Murray, Ken S. Rosenthal y Michael A. Pfaller. Elsevier España, S.L. ISBN: 9788491130765
- Microbiología y Parasitología Médicas (2012). Guillem Prats. Editorial Médica Panamericana. ISBN: 978-84-9835-429-4
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- Brock. Biologia de los Microorganismos, 14a Edition. (2015). Michael T. Madigan, John M. Martinko, Kelly S. Bender, Daniel H. Buckley y David A. Stahl. Pearson Educación S.A. ISBN: 9788490352793.
- Microbiología en Ciencias de la Salud: Conceptos y Aplicaciones, 3a Edición (2011) Manuel de la Rosa. Elsevier España, S.L. ISBN: 9788480866927
- Ocular Infection, , 2nd edition (2007). David Seal and Uwe Pleyer. Informa Healthcare USA, Inc. ISBN: 978-0-8493-9093-7

Additional

- Queratitis Infecciosas. Fundamentos, Técnicas Diagnósticas y Tratamiento (2006). Juan J. Perez-Santonja y José M. Hervás-Hernandis (editores). Ergon. ISBN: 978-84-8473-447-5
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- Microbiología de Prescott, Harley y Klein. Septima Edición (2008). Joanne Willey, Linda Sherwood and Christopher J. Woolverton. McGraw-Hill Interamericana de España S.L. ISBN: 9788448168278.
- Parasitología Médica, Quinta Edición (2019). Marco Antonio Becerril. McGraw-Hill/ Interamericana Editores S.A. de C.V. ISBN: 9786071514226.
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