COURSE DATA

DATA SUBJECT

Code: 34287
Name: Ocular biology
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1207 - Degree in Optics and Optometry	Facultat de Física	1	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1207 - Degree in Optics and Optometry	Biology	BASIC

COORDINATION

ALBEROLA ENGUIDANOS JUAN ANTONIO

NAVARRO MARZAL ALFONSO LUIS

MATEO JIMENEZ EVA MARIA

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 / LEARNING OUTCOMES

-

Ability to identify the different areas of the visual organ under the microscope.

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.

Knowing how to apply the knowledge acquired to professional activity, knowing how to solve problems and develop and defend arguments.

Knowledge of the structure and function of animal cells and tissues as well as systems related to the visual system.

To apply biochemical knowledge to the eye and the vision process.

To determine the development of the visual system.

To know the cell structure, embryonic development and organogenesis.

To know the composition and structure of the molecules that make up living beings.

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 recognize with macroscopic and microscopic methods the morphology and structure of tissues, organs and systems of the human body.

To study the molecular bases of the storage and expression of biological information.

To understand the transformations of some biomolecules in others.

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.

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

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

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

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	10,00
Theory	45,00
Laboratory	5,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	3,00
Independent study and work	50,00
Preparation of lessons	17,00
Preparation for assessment activities	20,00
Resolution of case studies	0,00
Total hours	**90,00**

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

The subject assessment considers the following parts, all evaluable out of 10 points.

Theory (T): The grade is the result of a written exam taken at the end of the term. The minimum grade to pass this part is 4.0 points.

Seminars (S): The grade will be based on the result of an exam of all seminars completed at the end of the term. The minimum grade to pass this part is 4.0 points. To obtain a grade in this section, at least 80% of the Seminar sessions must be attended.

Laboratory (L): The grade will be the result of an exam taken at the end of Laboratory sessions. The participation of the student throughout the Laboratory Sessions and the Laboratory Report will also be evaluated. The minimum grade to pass this part is 4.0 points. To obtain a score in this section, it is necessary to attend at least 80% of the Laboratory sessions.

The final grade (P) of the first call will be the result of applying the following formula: P = 0.600 T + 0.266 S + 0.134 L

In the second call, the written exam is taken, and the Seminar and Laboratory grades obtained in the first call are kept. The formula for the calculation of the final grade is also kept.

REFERENCES

- 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

- ntroducción a la Microbiología, 12a edición (2017) Gerard J. Tortora. Editorial Médica Panamericana. ISBN: 978-9500695404.

- 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

- 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

- Microbiologia y Parasitologia Humana. Bases etiológicas de las enfermedades infecciosas y parasitarias, 4a Edición. (2018). Rául Romero Cabello. Editorial Médica Panamericana. ISBN: 9786078546138.

- 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.

- Basic Medical Microbiology, First edition. (2018). Patrick R. Murray. Elsevier. ISBN: 9780323476768.

- Microbiology: A Laboratory Manual, 11th Edition, Global Edition. (2018). James G. Cappuccino y Chad T. Welsh. Pearson Education Limited. ISBN: 78-1-292-17578-2.