Course guide
370018 - MICRO - Microbiology

Last modified: 16/06/2025

Unit in charge: Terrassa School of Optics and Optometry
Teaching unit: 731 - OO - Department of Optics and Optometry.

Degree: BACHELOR'S DEGREE IN OPTICS AND OPTOMETRY (Syllabus 2020). (Compulsory subject).

Academic year: 2025 **ECTS Credits:** 6.0 **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer: Miquel Bellmunt, Nuria (https://futur.upc.edu/NuriaMiquelBellmunt)
Morató Farreras, Jordi (https://futur.upc.edu/JordiMoratoFarreras)

Others:

PRIOR SKILLS

The knowledge acquired in the subjects of Anatomy of the Visual System and Physiology and Biochemistry taken in the Degree in Optics and Optometry
They will constitute the essential basis to be able to carry out correct monitoring and use of the subject.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CE02. Determine the functions of systems in the human body. Demonstrate knowledge of the principles and foundations of the biological processes involved in the normal functioning of the visual system. Recognise, with macroscopic and microscopic methods, the morphology and structure of the tissues, organs and systems in the human body. Demonstrate knowledge of and describe, macroscopically and microscopically, the structures that make up the visual system and ocular adnexa. Demonstrate knowledge of the structure of the cell, embryonic development and organogenesis. Describe the development of the visual system. Demonstrate knowledge of the microorganisms involved in visual system disorders. Demonstrate knowledge of the properties and functions of the various parts that make up the visual system.
CE07. (ENG) The ability to understand and manage basic laboratory materials and techniques.

Generical:
CG8. Plan and carry out research projects that contribute to the production of knowledge in the field of optometry and disseminate this scientific knowledge via the typical communication channels.
CG13. Demonstrate and interpret methods for critical analysis and theory development and apply them to the field of optometry.

Transversal:
CT7. Foreign language. Demonstrate knowledge of a foreign language, preferably English, at an oral and written level that is consistent with graduates' future needs.

TEACHING METHODOLOGY

MD1: Expository, participative class with theoretical and practical content
MD2: Active methodologies in the classroom (project-based learning (PBL), case study, role-playing, cooperative learning, ...)
MD4: Laboratory practices
MD7 - Tutorials.
To keep track of the subject you need to look at Athena often.

LEARNING OBJECTIVES OF THE SUBJECT

To know the basic microbiological concepts. To know the different microorganisms involved in diseases of the visual system and to learn how they act, how our organism defends itself and how to avoid or destroy them.

STUDY LOAD

Type	Hours	Percentage
Hours medium group	45,0	30.00
Self study	90,0	60.00
Hours small group	15,0	10.00

Total learning time: 150 h

CONTENTS

Introduction to microbiology

Description:
1. History and evolution of microbiology
2. The prokaryotic cell vs. the eukaryotic cell

Specific objectives:
To learn how knowledge about microorganisms evolved as the observation apparatus was perfected, until reaching the current knowledge. Know and differentiate the different types of prokaryotic and eukaryotic cells, as well as the classification of living beings based on their structural characteristics. Reasoning how this knowledge affected the concept of the origin of diseases.

Related activities:
Marine and terrestrial depths

Full-or-part-time: 6h
Practical classes: 2h
Self study : 4h

2. What are microorganisms?

Description:
1. Bacteria
a. Morphology, structure and composition of bacteria
b. Classification of bacteria
c. Cell and population growth
d. Biofilms
2. Archaea, extremophiles and the origin of life
3. Viruses
a Morphology, structure and composition of viruses
b. Classification of viruses
c. Characteristics of virus-host cell relationships
4. Prions
5. Fungi
a. Microscopic fungi.
b. General characteristics and cellular structure
c. Filamentous fungi and yeasts
6. Protozoa
7. Helminths
8. Arthropods
9. Defense systems of microorganisms

Specific objectives:
Know the different types of microorganisms, and their biological characteristics of growth and reproduction. Study the systems of resistance, pathogenicity and virulence. Learn how microbial diseases occur, how to avoid them, how resistance to antibiotics is generated and the consequences of multi-resistance.

Related activities:
1. The size of the microorganisms
2. Knowledge of microorganisms
3. A lactic fermentation will be carried out to see how the action of the lactic bacteria evolves the milk into yogurt by experimenting with different temperatures
4. An alcoholic fermentation will be carried out to see how the flour evolves due to the action of the yeasts, obtaining alcohol and Co2

Full-or-part-time: 46h
Practical classes: 13h 20m
Laboratory classes: 6h
Self study : 26h 40m

3. Microbiological observation and diagnosis tools for eye infections

Description:
1. Microscopy
a. History of microscopes
b. Types of microscopes
2. Cultivation media and techniques, and micro-organism isolation techniques
3. Stains
4. Molecular microbiology (PCR)

Specific objectives:
Learn about the evolution of the different optical magnification devices from the most basic to modern electron microscopes. Study of the types of cultures: basic, selective, enrichment cultures ... adapted to the biological needs of the different microorganisms. Microorganism isolation techniques, and knowledge of the most common stains used in laboratories. Current and future molecular diagnostic techniques.

Related activities:
Students will learn to use an optical microscope, and to observe and differentiate microorganisms based on their morphological and staining characteristics. Routine Gram stain.
Plate cultures will be made and the growth colonies will be observed and how the pH and nutrients of the medium affect the growth.

Full-or-part-time: 18h
Practical classes: 4h
Laboratory classes: 6h
Self study : 8h

4. Pathogenic microorganisms

Description:
1. Methodology of laboratory diagnosis
2. Main microorganisms causing eye diseases
a. Bacterial eye infections
b. Fungal eye infections
c. Eye infections due to viruses
d. Eye infections by protozoa
e. Ocular helminth infections
f. Ocular myiasis
g. Mite infestations
3. Corneal transplant infections

Specific objectives:
Know how the defensive system works: specific and non-specific immunity, immune privilege, hypersensitivity and autoimmunity. Know the main microscopic pathogens that affect the visual system, main routes of contagion, epidemiology and prophylaxis. Learn how to laboratory diagnose the different microorganisms involved in an infection. Know the mechanisms for making a vaccine, types of vaccines, and their applications.

Related activities:
Researching a new antivirus.

Full-or-part-time: 43h
Practical classes: 14h 20m
Self study : 28h 40m

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Description:
5. Prevention and treatment of pathologies caused by microorganisms

Specific objectives:
Know the different types of antimicrobials, the mechanisms of action and their effects on microorganisms. Know when, where and how to apply each of them, as well as their toxicities.

Full-or-part-time: 12h
Practical classes: 3h
Laboratory classes: 6h
Self study : 3h

6. Contagion methodologies and defense systems

Description:
1. Methods of contagion
2. Immune system: immunity, autoimmunity, hypersensitivity
3. Immune privilege
4. Eye defense mechanisms
5. Vaccines

Full-or-part-time: 25h
Theory classes: 8h 20m
Self study : 16h 40m

ACTIVITIES

1. Laboratory exercises

Description:
The purpose of the activities is to bring the knowledge acquired in the theory classes closer to the student, incorporating new knowledge and skills. The student will learn to use an optical microscope, to perform cultures, stains and to differentiate the different microorganisms by carrying out various activities. All the practices carried out are aimed at achieving the competences of the European diploma included in C18 General Microbiology and Immunology.Attendance is mandatory.

Full-or-part-time: 20h
Self study: 12h
Laboratory classes: 8h

Group work will be encouraged to consolidate the theoretical knowledge that the student has acquired.

Description:

Full-or-part-time: 10h 30m
Self study: 10h 30m

3. Evaluation questionnaires

Description:
The questionnaires consist of taking tests with test-type answers, in order to establish concepts and clarify any doubts that may arise.

Full-or-part-time: 6h
Practical classes: 6h

4. Theoretical assessment tests

Description:
These tests consist of two theoretical exams that will allow the student to evaluate the knowledge acquired throughout the course.
The specific, generic, transversal skills as well as those of the European diploma will be achieved as long as the final grade of the subject is equal to or higher than 5.
Students who fail both midterms with an average grade of 3.5 or higher will have the option of recovering it through a reassessment exam. This re-evaluation will be carried out according to the general conditions established for each year by the UPC's academic regulations for undergraduate and master's studies (NAGRAMA) and the specific conditions established by the Terrassa Faculty of Optics and Optometry. It will consist of an examination of all the subjects developed in the subject during the course. Students who pass the reassessment exam will have a final grade of 5 in the subject. Otherwise, the higher grade of the two obtained will be maintained.

Full-or-part-time: 3h
Practical classes: 3h

5. Optional exercises

Description:
Students will be offered the possibility of carrying out additional, non-evaluable exercises, which will allow them to consolidate the knowledge acquired and self-assess the level of achievement, using various platforms.

Full-or-part-time: 3h
Self study: 3h

EUROPEAN DIPLOMA IN OPTOMETRY COMPETENCES

Description:
This module contributes to the European Diploma in Optometry competencies indicated in the following link:
https://drive.google.com/drive/folders/1bwmHBsvkrGnY63DfXAnWZB_i0I2pXa-I?usp=drive_link

GRADING SYSTEM

The assessment will be done through continuous assessment.
The evaluation of the subject is divided between two partial exams (P1 and P2)
There will be no make-up exams.
Transversal skills are assessed through questionnaires (CT6)
The specific, generic and transversal skills will be achieved as long as the final grade of the subject is equal to or higher than 5.
Students who fail the subject with a grade greater than or equal to 3.5 will have the option to recover it through a "re-evaluation" exam. This re-evaluation will be carried out under the general conditions established for each year by the academic regulations for degrees and masters of the UPC (NAGRAMA) and the particulars established by the Faculty of Optics and Optometry of Terrassa.
It will consist of an examination of all the subjects developed in the subject during the course. Students who pass the reassessment exam will have a final grade of 5 in the subject. Otherwise, the higher grade of the two obtained will be maintained.

EXAMINATION RULES.

It is necessary to have done all the activities. Deliveries must follow the instructions given in each case.

In case of partial or total copying in any of the evaluations of the subject, what is provided for in the Academic Regulations for undergraduate and master's studies of the UPC will apply: "Irregular actions that can lead to a significant variation in the qualification of one or more students constitute a fraudulent performance of an assessment act. This action entails the descriptive qualification of suspension and a numerical grade of 0 for the evaluation act and the subject, without prejudice to the disciplinary process that may arise as a result of the acts carried out.
If the student considers the decision to be incorrect, he or she can file a complaint with the director or the dean of the educational center and, if the answer does not satisfy him or her, he or she can file an appeal with the rector.
The total or partial reproduction of academic or research works, or their use for any other purpose, must have the explicit authorization of the authors.
It is up to the director or the dean of the teaching center to resolve allegations about aspects not included in the regulations."

BIBLIOGRAPHY

Basic:
- Madigan, Michael T; Martinko, John M; Parker, Jack. Brock biología de los microorganismos [on line]. 14ª ed. Madrid [etc.]: Pearson Educación S.A., cop. 2015 [Consultation: 06/05/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=5850. ISBN 9788490352793.
- Murray, Patrick R; Rosenthal, Ken S; Pfaller, Michael A. Microbiología médica. 6ª ed. Elsevier Science, cop. 2009. ISBN 9788480864657.
- Ingraham, John L; Ingraham, Catherine A. Introduction to microbiology. 2nd ed. Pacific Grove: Brooks/Cole Thomson Learning, cop. 2004. ISBN 0534394655.
- Stagner, Anna M [et al.]. "Infections of the eye and its adnexa". Kradin, Richard L. Diagnostic pathology of infectious disease. Philadelphia: Elsevier, 2018. p. 648-685.
- Díaz López, MD [et al.]. Diagnóstico microbiológico de las infecciones oculares [on line]. Madrid: Sociedad Española de Enfermedades Infecciosas y Microbiología, 2019 [Consultation: 23/02/2023]. Available on: https://seimc.org/contenidos/documentoscientificos/procedimientosmicrobiologia/seimc-procedimientomicrobiologia31A.pdf. ISBN 9788409158775.
- Mukherejee, Siddhartha. La armonía de las células. Barcelona: Debate, 2023. ISBN 9788419399465.

Complementary:
- Gardner, Joan F; Peel, Margaret M. Introduction to sterilization, disinfection and infection control. 2nd ed. Melbourne [etc.]: Churchill Livingstone, cop. 1991. ISBN 0443042861.
- Renneberg, Reinhard; Centelles Serra, Josep Joan; Ferrer Peralta, María Magdalena. Biotecnología para principiantes [on line]. Barcelona: Reverté, cop. 2008 [Consultation: 09/05/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=8599. ISBN 9788429174830.
- Archivos de la Sociedad Española de Oftalmología. Madrid: Elsevier Doyma, 1971-.
- Blaser, Martin J. Mandell, Douglas, and Bennett's principles and practice of infectious diseases. 10th ed. Philadelphia: Elsevier, 2026. ISBN 9780323934992.

RESOURCES

Audiovisual material:
- Nom recurs. Resource