Course guide
370011 - FIBI - Physiology and Biochemistry

Last modified: 27/06/2025

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

LECTURER

Coordinating lecturer: Volta Duran, Eric

Others: Volta Duran, Eric

PRIOR SKILLS

The knowledge acquired in the subjects of Head's Anatomy and Histology and the Visual System Anatomy, as well as Chemistry for Vision Sciences, all of them taught during the first year of the Degree in Optics and Optometry, will be the essential basis for understanding the general physiological and biochemical characteristics and those related to vision and ocular annexes.

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.
CE05. (ENG) The ability to understand the structure of matter, the chemical processes of solutions and the structure, properties and reactivity of organic compounds. The ability to understand the composition and structure of the molecules that make up living beings. The ability to understand the transformation of certain biomolecules into others. The ability to study the molecular basis of the storage and expression of biological information. The ability to apply biochemical knowledge to the eye and the process of vision.

CE07. (ENG) The ability to understand and manage basic laboratory materials and techniques.
CE13. Understand the factors that limit retinal image quality. Demonstrate knowledge of the spatial and temporal aspects of vision. Carry out psychophysical tests to determine levels of visual perception. Demonstrate knowledge of the functioning of the retina as a receptor of radiant energy. Demonstrate knowledge of the basic models of vision of colour, shape and movement. Demonstrate knowledge of age-related changes in perceptual processes. Measure and interpret psychophysical data obtained from an assessment of visual perception.

Generical:
CG11. Locate new information and interpret it in context.

Transversal:
CT4. (ENG) Teamwork. The ability to work as a member of an interdisciplinary team, as just another member or in a leadership role, who can contribute to developing projects pragmatically and with a sense of responsibility and make commitments that take into account the resources that are available.
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 - Participative expository class on theoretical and practical contents.
MD3 - Practical class involving students in solving practical cases and/or exercises related to course content.
MD4 - Laboratory practices.
MD5 - Reading of educational material, texts, and articles related to course content.
MD6 - Completion of problems, exercises, assignments, and resolution of doubts through the virtual campus Atenea.
MD7 - Tutoring sessions.

To access the laboratory and participate in practical sessions, it will be necessary to bring specified materials (script, lab coat, goggles, etc.).
Any absences must be justified.
Laboratory sessions and seminars not held on the scheduled dates, whether justified or not, cannot be rescheduled.
Non-attendance in assessable remote activities can only be made up if the absence is properly justified.
For effective course tracking, it is recommended to regularly check instructions communicated via the virtual campus ATENEA.

LEARNING OBJECTIVES OF THE SUBJECT

- Understanding the physiological and biochemical processes of the human body, as well as the transformations of biomolecules into others.
- Understanding the biochemical processes that occur in the eye and vision.

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

Description:
Topic 1. Introduction to Biochemistry and Physiology.
Topic 2. Homeostasis.

Some topics can be merged or divided to facilitate student understanding.

Specific objectives:
- Contextualize Biochemistry and Physiology within the field of biological sciences.
- Understand the general principles of Biochemistry and Physiology, emphasizing their importance in maintaining homeostasis in the human body and specifically in the visual system.

Related activities:
- Group activities may incorporate content from this section.

Full-or-part-time: 5h
Practical classes: 2h
Self study : 3h

Fundamentals of biochemestry and phisiology

Description:
Topic 3. Biomolecules.
Topic 4. Fundamentals of molecular biology.
Topic 5. Enzymes.
Topic 6. Biological Membranes and Cellular Transport.
Topic 7. Cell signaling.
Topic 8. Fundamentals of metabolism.
Topic 9. Fundamentals of genetics.
Topic 10. Circulatory Physiology.
Topic 11. Neuromuscular Physiology.
Topic 12. Endocrine system
Topic 13. Other systems of the human body

Some topics can be merged or divided to facilitate student understanding.

Specific objectives:
- Understand the biochemical processes that enable the maintenance of homeostasis in the human body as a prerequisite for understanding the functioning of the different structures of the visual system and its ocular annexes.
- Understand the normal functioning of physiological systems in the human body that are related to the visual system and ocular annexes.

Related activities:
- Lab practice 1, 2 and 3.
- Group activities may incorporate content from this section.

Full-or-part-time: 56h 30m
Practical classes: 17h
Laboratory classes: 7h
Self study : 32h 30m

Physiology and Biochemistry of the Visual System

Description:
Topic 14. Eyelids.
Topic 15. Oculomotor muscles.
Topic 16. Lacrimal apparatus.
Topic 17. Cornea and sclera.
Topic 18. Aqueous humor and vitreous body.
Topic 19. Iris and pupil.
Topic 20. Lens and ciliary body.

Some topics can be merged or divided to facilitate student understanding.

Specific objectives:
- To understand the biochemical properties and physiological processes of the various components of the visual system and ocular annexes through detailed study.
- To understand how the characteristics and functions of the elements of the visual system and ocular annexes contribute to the homeostasis of this sensory system.

Related activities:
- Lab practices 4 and 5 (together with the section Neurophysiology and Vision Biochemistry)
- Group activities may incorporate content from this section

Full-or-part-time: 51h
Practical classes: 15h
Laboratory classes: 4h
Self study : 32h

Neurofisiologia y Bioquímica de la Visión

Description:
Tema 21. Retina.
Tema 22. Neurophysiology of vision
Tema 23. Biochemistry of vision

Some topics can be merged or divided to facilitate student understanding.

Specific objectives:
- Understand the basics of neurophysiology as a foundation for comprehending nervous system physiology within the visual system.
- Understand the processes related to the biochemistry of vision (phototransduction).
- Understand the fundamentals of visual signal processing in the retina, visual pathways, and visual signal in the visual cortex.

Related activities:
- Lab practices 4 and 5 (together with the section Physiology and Biochemistry of the Visual System)
- Group activities may incorporate content from this section.

Full-or-part-time: 37h 30m
Practical classes: 11h
Laboratory classes: 4h
Self study : 22h 30m

ACTIVITIES

THEORETICAL ASSESSMENT TESTS

Description:
Individual tests in the classroom. Two partial exams will be performed, consisting of test questions (T/F and multiple choice) with penalties for incorrect answers and short answer and writing questions. The exams will assess the theoretical content of the course, encompassing all the learning objectives of the subject. The grades from the theoretical assessment tests represent 60% (30% from the 1st partial exam + 30% from the 2nd partial exam) of the final course grade.

Specific objectives:
Demonstrate the ability to apply the biochemical and physiological knowledge acquired during the theoretical sessions, as well as the achievement of the generic and specific competencies of the course.

Material:
- Theory presentations, available on ATENEA.
- Recommended bibliography.

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

GROUP ACTIVITIES

Description:
Two collaborative group activities will be conducted, integrating the different objectives of the subject. Students will work in small groups guided by the professor to analyze and investigate a real situation and achieve a part of the knowledge and skills of the subject. These activities will be evaluated by individual and/or group assessment. Grades from ABP will account for the 20% of the final grade (GA1=10% + GA2=10%)

Specific objectives:
Integrate and contextualize the theoretical knowledge from the subject, working in teams to solve the proposed problems.

Material:
Available on ATENEA:
- Seminar instructions.
- Support materials (PBL scenarios, scientific articles, presentations, videos, complementary texts).

Delivery:
Within the established deadline, it will be necessary to submit the completed activities or assignments. The possibility of evaluating activities through oral presentations and oral tests is included.

Full-or-part-time: 9h
Practical classes: 4h
Self study: 5h

LABORATORY PRACTICES

Description:
Laboratory practices
The sessions will be conducted in groups of 2-3 students, with a duration of 1.5 to 2 hours.
To facilitate the achievement of the proposed objectives, students will have access to the corresponding scripts on ATENEA before the practices, and they will need to individually complete a questionnaire on ATENEA.
After each practice, students will be required to individually complete a questionnaire in person or using ATENEA.
The practices will be assessed through the post-practice questionnaires, which will be considered as continuous assessment activities (20%)

Specific objectives:
Reinforce and assimilate the knowledge previously acquired in the theoretical part of the subject.
Acquire specific competences of lab work.

Material:
Available on ATENEA:
- Detailed scripts of the practices.
- Questionnaires that students will need to fill out after the practices.
- Presentations of the practices (after their completion).

AVAILABLE AT THE LAB:
- Material needed for performe each practice
- Lab practices presentations

To access the laboratory and participate in practical sessions, it will be necessary to bring specified materials (script, lab coat, protection glasses, etc.).

Full-or-part-time: 18h 40m
Laboratory classes: 12h
Self study: 6h 40m

OPTIONAL ACTIVITIES

Description:
Students will have access on Atenea to a series of optional theoretical and/or practical exercises for autonomous learning, aimed at reinforcing the knowledge acquired during the in-person sessions.

Specific objectives:
To reinforce the knowledge acquired in "on person" sessions.

Material:
Optional exercises

Full-or-part-time: 2h
Self study: 2h

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

Full-or-part-time: 1h
Practical classes: 1h

GRADING SYSTEM

Two assessment tests will evaluate the theoretical content: T1 (30%) and T2 (30%).
Questionnaires will be conducted after each practice. Lab grade will be the mean of the questionnaires: P (20%).
Two group activities will be conducted during the course. Each activity will have a weight of 10% in the final grade: GA (20%)
Final grade: (0.30·T1) + (0.30·T2) + (0.20·P) + (0.20·GA).

Attendance to lab practices is mandatory. In case of unjustified lack of attendance, the grading for the P block (20%) will be 0. The same rule applies for evaluation activities T1, T2 and each GA.

No partial recovery assessments will be organized.

The generic, specific and transversal competencies of the course will be evaluated with theoretical content, group activities and laboratory practices. The competencies of the European Diploma of the course will be evaluated with theoretical content, group activities and laboratory practices.

The specific, generic, and transversal competencies and those of the European Diploma will be achieved as long as the final grade of the course is equal to or greater than 5.
Students who fail the course with a grade equal to or greater than 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 each course by the academic regulations of degrees and masters of the UPC (NAGRAMA) and the specific ones established by the Faculty of Optics and Optometry of Terrassa, and it will take place within the periods established in the center's academic calendar. The re-evaluation will consist of an exam on all the theoretical topics covered in the course during the term. Students who pass the re-evaluation exam will have a maximum final grade of 5 in the course. If they take the re-evaluation and do not pass it, the student will keep the highest grade between the one obtained with the regular assessment method and the one obtained in the re-evaluation exam.

EXAMINATION RULES.

- Attendance to theoretical classes, practical sessions, and group activities is mandatory.
- Completion of all assessable activities and exams is mandatory.
- If any assessable activity is not completed without justification, it will be scored as a 0.
- UPC regulations will be applied in case of detecting cheating during exams.
- In case of partial or complete copying in any assessment of the course, the provisions of the Academic Regulations of undergraduate and master's studies at UPC will apply:

"Actions that can lead to a significant variation in the grade of one or more students constitute the fraudulent completion of an assessment task. This action results in a descriptive grade of “fail” and a numerical grade of 0 for the assessment task and the course, without prejudice to any disciplinary process that may result from these actions.
If the student considers the decision incorrect, they may file a complaint through an application to the director or dean of the school, and if unsatisfied with the response, they may appeal to the rector.
The complete or partial reproduction of academic or research work, or its use for any other purpose, requires explicit authorization from the authors.
It is the responsibility of the director or dean of the school to resolve allegations regarding aspects not covered in the regulations."

BIBLIOGRAPHY

Basic:

- Levin, Leonard A. [et al.]. Adler’s physiology of the eye. 11th edition. Edinburgh [etc.]: Saunders Elsevier, cop. 2011. ISBN 9780323057141.
- Forrester John V. The eye: basic sciences in practice [on line]. 4th ed. Edinburg [etc.]: Elsevier, 2016 [Consultation: 05/07/2024]. Available on: https://www-sciencedirect-com.recursos.biblioteca.upc.edu/book/9780702055546/the-eye. ISBN 9780702055546.
- Nemeth, S.; Ledford, J.K.; Lens, A. Ocular anatomy and physiology [on line]. 2nd ed. Thorofare, New Jersey: SLACK, 2008 [Consultation: 25/07/2024]. Available on: https://search-ebscohost-com.recursos.biblioteca.upc.edu/login.aspx?direct=true&AuthType=ip,uid&db=nlebk&AN=1384046&site=ehost-live&ebv=EB&ppid=pp_Cover. ISBN 9781556427923.
- Nelson David L.; Cox, Michael M. Lehninger principios de bioquímica. 7ª edición. Barcelona: Omega, 2018. ISBN 9788428216678.
- Kandel Eric R.; Schwartz, James H.; Jessell, Thomas M. Principios de neurociencia. 4ª edición. Madrid: McGraw Hill Interamericana, 2001. ISBN 8448603117.
- Hall, John E.; Guyton, Arthur C. Tratado de fisiología médica. 13ª edición. Barcelona: Elsevier, 2016. ISBN 9788491130246.

RESOURCES

Other resources:
It is recommended to check the specific bibliography and resources indicated by the professor on in-person classes and through ATENEA.