UAB
Universitat Autònoma de Barcelona

Advanced Histology

Code: 100784
ECTS Credits: 6

2024/2025

Degree	Type	Year
2500004 Biology	OB	2

Contact

Name: Joaquín Martí Clua

Email: joaquim.marti.clua@uab.cat

Teachers

Joaquín Martí Clua

Teaching groups languages

You can view this information at the end of this document.

Prerequisites

A working knowledge of Histology 1 course content is required.

To have the right to attend the laboratory classes, the student must show that he/she has passed the biosafety tests uploaded in the Virtual Campus.

Objectives and Contextualisation

Is an obligatory subject in the 2th year, concerning the cellular and tissue bases of animals and plants. It has been designed assuming students have a basic knowledge of histology 1 course content. Students who have passed both subjects, have the possibility of acquire a comprehensive understanding and an integrated approach to the organization of animals in the elective subject "Histology of organs and systems" and "developmental biology in the 4th year.

The subject consists of two distinct parts: Neurohistology and plant histology.

The theoretical and practical nature of this subject allows linking scientific concepts with practical work.

The main goals of the subject are:

1. Recognize, in terms of cell biology, the diversity of animal neuronal cells.

2. Acquire the integrative concept of neuron from a morpho-functional perspective.

3. Know about the structure, organization and basic functioning of different glial cells.

4. Identify the cytophysiological characteristics that define different plant tissues.

5. Understand the generation, differentiation and cell death that allow the survival of plant tissue.

6. Apply basic histological techniques to the diagnosis of different animal and plant tissue samples.

7. Recognize different neuronal and glial cells by microscopy.

8. Identify the variety of plant tissues and their intracellular and extracellular components by microscopy.

Competences

- Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
- Be able to analyse and synthesise
- Be able to organise and plan.
- Design and carry out biodiagnoses and identify and use bioindicators.
- Isolate, identify and analyse material of biological origin.
- Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
- Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
- Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
- Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
- Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
- Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
- Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
- Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
- Understand the processes that determine the functioning of living beings in each of their levels of organisation.
- Work in teams.

Learning Outcomes

1. Analyse a situation and identify its points for improvement.
2. Be able to analyse and synthesise.
3. Be able to organise and plan.
4. Critically analyse the principles, values and procedures that govern the exercise of the profession.
5. Describe animal and plant tissues, taking into account the morphology, microscopic and ultra-microscopic structure and cytophysiology of their components.
6. Identify the cell types that, while maintaining their differentiation, coexist in a single tissue environment.
7. Obtain samples of animal or plant material and use histological methodologies to perform a microscopic analysis.
8. Propose new methods or well-founded alternative solutions.
9. Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
10. Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.

11. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
12. Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
13. Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
14. Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
15. Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
16. Work in teams.

Content

THEORY LECTURES

Tema 1. Nervous tissue.

Cellular components of nerve tissue. Neuron: morphofunctional regionalization. Axonal flow. Structural bases of the generation and propagation of the nervous impulse. The interneuronal synapse: transmission mechanisms. Exciting or inhibitory effects of neurotransmitters. Neuromuscular junction: motor plate.

Tema 2. Neuroglía.

Concept of neuroglia. Glial types and distribution. Astrocytes. Oligodendrocytes. Microglia: functional meaning. Ependymocytes and epithelium of the choroid plexus. Satellite cells of the peripheral ganglia. Schwann cell. Nervous fiber. Myelin sheath.

Tema 3. Characteristic of plant cell.

The cell wall. Plasmodesmata and symplastic transport. Pits. Tissue concept in higher plants. Tissue growth and differentiation. Classification of plant tissues.

Tema 4. Meristems.

cyto physiological basis. Apical meristems: histogenic organization and proliferative patterns. Cambium: Fusiform initials and ray initials cells. axial and radial systems. Phellogen: structure and histogenesis.

Tema 5. Parenchyma.

Morphofunctional diversity of parenchyma cells. Tissular organization patterns. chlorenchyma and storage parenchyma. root endodermis. Passage cells.

Tema 6. Mechanical plant tissues.

Collenchyma: Collenchyma cells. Tissular distrubution and organization. functional meaning in the primary growth. Sclerenchyma: fibers and sclereids. Sclerenchyma cells.

Tema 7. Xylem.

Tracheary elements: tracheids and vessel elements. Wall cell:secondary wall thickenings and perforation plates. xylem fibres and xylem parenchyma. Developmental Patterns of tracheary elements. Histogenesis and cellular differentiation. Primary Xylem: protoxylem and metaxylem in roots and stems. Secundary Xylem: morphogenesis in root and stem. Growth rings.

Tema 8. Phloem.

Sieve elements: sieve cells and sieve tube elements. Sieve area and sieve plate. Callose deposition. Phloem parenchyma: companion cells. sclereids and phloem fibres. Cytodifferentiation of sieve elements. Primary phloem: protophloem and metaphloem in root and stem. Secundary phloem: morphogenesis in root and stem.

Tema 9. Dermal plant tissues.

Epidermis: morphofunctional diversity. root epidermis: root hairs. Cuticle and epicuticular waxes. Trichomes. Stomata: structure and cytophysiology. Periderm: tissular organization.

LABORATORY PRACTICES

Práctica 1. histological staining of neural tissue. Image Analysis of Micrographs.

Práctica 2. Cytochemical staining of nuclear DNA in apical meristems: feulgen staining technique. Microscopic identification of specialized cell wall structures. Microscopic identification of meristems. Image Analysis of Micrographs.

Práctica 3. Microscopic identification of parenchyma, mechanical and dermal tissues. Image Analysis of Micrographs.

Práctica 4. Microscopic identification of vascular tissues: primary and secundary plant growth. Image Analysis of Micrographs.

One of the laboratory practice groups will be taught in English; students can freely sign up for this group before the start of the course

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
LABORATORY PRACTICES	14	0.56	15, 14, 4, 1, 5, 6, 7, 8, 13, 12, 11, 9, 10, 2, 3, 16
SEMINARS	6	0.24	15, 14, 4, 1, 5, 6, 7, 8, 13, 12, 11, 9, 10, 2, 3, 16
THEORY LECTURES	30	1.2	15, 14, 4, 1, 5, 6, 7, 8, 13, 12, 11, 9, 10, 2, 3, 16
Type: Supervised			
TUTORIALS	6	0.24	15, 14, 4, 1, 5, 6, 7, 8, 13, 12, 11, 9, 10, 2, 3, 16
Type: Autonomous			
PREPARATION OF SEMINARS	25	1	15, 14, 4, 1, 5, 6, 7, 8, 13, 12, 11, 9, 10, 2, 3, 16
QUESTIONNAIRES RESOLUTION	2.5	0.1	15, 14, 4, 1, 5, 6, 7, 8, 13, 12, 11, 9, 10, 2, 3, 16
STUDY	60	2.4	15, 14, 4, 1, 5, 6, 7, 8, 13, 12, 11, 9, 10, 2, 3, 16

The subject includes theory lectures, seminars and practical classes.

Theory Lectures

The subjects of teaching units will be taught in 36 sessions. They will be taught using audiovisual material prepared by the teacher. Students will have such material available in the Virtual Campus.

Seminars

The scheduled seminars are designed in order to students work in small groups to acquire teamwork and critical thinking skills. Students will be divided into working groups for a common work outside and inside the classroom.

There are two types of seminars:

1. Diagnostic problems. Resolution of diagnistic problems by microscopy analysis related with lessons treated in the theory lectures. At the beginning of the session, each group of students will get a questionary related with the display of cells and tissues. Each workgroup must deliver in writing the resolution of their own diagnostic problem.

2. Work delivery. Students will be divided into working groups for a specific program topic, followed by oral presentations and collective discussion. The organization of the groups and the distribution of topics to be discussed will take place during the first seminar. In the remaining seminars, groups of students must deliver in writing their proposed topic to the professor. Each group of students will present the topic orally to the rest of the class with the resources available in the classroom.

The recommended bibliography and scientific articles related to the subject of study will be posted on the Virtual Campus.

Seminar attendance is mandatory.

Tutorials

Tutoring will be done personally in the professor's office (times to be arranged). Tutorials should be used to clarify concepts and consolidate the knowledge acquired by the personal work of the student. They can also be useful to answer questions that students may have about the preparation of seminars.

Laboratory practices

Practical sessions will be taught in small groups of students (about 20 per session) in the laboratory. They are designed to complement the theoretical training. Students will perform microscopy diagnoses and will delivery individual questionnaires.

Students will get a practice manual of practices (VC) at the beginning of the course. For a good work performance and acquire skills relevant to this subject, is essential a reading comprehension of the manual before carring out each practice.

Monitoring the practical classes also involves the collection of individual observations from microscopic examination in a portfolio of activities (Virtual Campus).

Practical class attendanceis mandatory.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
PRACTICES	20%	1	0.04	15, 14, 4, 1, 5, 6, 7, 8, 13, 12, 11, 9, 10, 2, 3, 16
SEMINARS	10%	0.5	0.02	15, 14, 4, 1, 5, 6, 7, 8, 13, 12, 11, 9, 10, 2, 3, 16

THEORY EXAMS	70%	5	0.2	15, 14, 4, 1, 5, 6, 7, 8, 13, 12, 11, 9, 10, 2, 3, 16

The evaluation of the course will be continued through individual tests of theoretical and practical knowledge and group activities scheduled on the seminars.

The evaluation system is organized into three sections, each of which is independently evaluated:

Written exams (weight 70% of the final mark). The knowledge acquired by students will be evaluated through test exams. There will be two midterm exams (eliminatory) throughout the course and a final re-assessment test (see program of the subject).

Seminars (weight 10% of the final mark). This section assesses the ability of analysis and synthesis of students in each group, as well as cooperative learning and oral presentation skills.

Seminars will be assessed as follows:

Written work	40%	The professor evaluates (from 1 to 10) the works delivered by each group of students.
Oral presentation	15%	The professor evaluates (from 1 to 10) the oral presentations skills of each group of students.
Inter-group mark	5%	Each working roup evaluates (from 1 to 10) the groups that present orally their subject of study.
Problems	30%	The professor evaluates (from1 to 10) problems solved for each working wroup
Intra-group mark	10%	Within each working group, each student assesses (from 1 to 10) to his co-workers at the last seminar.
TOTAL	100%	

Seminar attendance is mandatory. In case of absence to any session, without justification, there will be a penalization in the final mark of the seminar:

- Absence 1 session = 20% reduction of the mark
- Absence 2 sessions = 40% reduction of the mark
- Absence 3 sessions = 80% reduction of the mark

Practicals (weight 20% of the final mark). This section evaluates the practical knowledge acquired individually by each student.

Practicals will be assessed according with two modalities:

1. Evaluation of the content at the end of each practical class (50% of the mark). Students will respond, in a limited time, to a questionnaire and will make a diagnosis of structures using microscopic examination.

The grade will be the average of the marks obtained in each practical session.

2. Global test of microscopic diagnostic skills (50% of the mark). This test will consist in the diagnosis of structures through microscopic examination proposed along the course.

To weigh the marks obtained in these two modalities, the student must achieve a mark greater than or equal to 4 (out of 10) on each of them.

Attendance at practicals is mandatory. In case of absence to any session, without justification, the mark corresponding to this practical will be 0.

Students who obtain a final mark lower than 5 (out of 10) cannot compensate it with marks corresponding to writtentheory tests andseminars.Therefore, they must do a re-assessment final test consisting in a microscopic diagnosis plus questions and answers.

To pass the course the requirements to be met are:

- Obtain at least 5 points, out of 10, in the average score of written theory tests and seminars.

- Obtain at least 5 points, out of 10, in the practical sessions.

The presentation of the student to any re-assessment test (theory and/or practices) automatically removes the mark previously obtained.

Students who have shown evidence of learning with an overall score of less than 50% will be marked as "not evaluated".

Repeat students:

Repeat students will not repeat a particular written test, seminar or practical if he/she has obtained at least a minimum mark of 5 in any of them. This exemption will be maintained for a period of three additional enrolments in the subject.

Single evaluation

The subject "Histology of Organs and Systems" has a single evaluation. To ensure that the single assessment certifies the achievement of the learning objectives and outcomes, the following evaluation activities will be carried out:

(I) Written test (represents 60% of the overall grade). In this section, the knowledge acquired by the student throughout the course will be evaluated individually. It will consist of a single multiple-choice exam. People who have obtained a score below 4 will have to take a recovery test. The same recovery system shall be applied as for continuous evaluation.

(II) Seminars (represent 20% of the overall grade). The seminars assess the students' capacity for analysis and synthesis, as well as group work and oral presentation skills. Attendance at seminars is compulsory. Therefore, their evaluation and penalty for not attending without just cause is the same as that indicated in the continuous evaluation section.

III) Internships (represent 20% of the overall grade). The histology of organs and systems is an eminently "visual" subject where the student uses the optical microscope to study different devices and systems. Internships are mandatory. The evaluation of the practices and the penalty for not attending without just cause is the same as that indicated in the continuous evaluation section.

The revision of the final grade follows the same procedure as for continuous evaluation.

Bibliography

TEXTS

Neurohistology:

Alberts y col. : Biologia Molecular de la Célula (ed. Omega).

Gartner, L.P. Hiatt, J.L.: Texto atlas de Histología (ed. McGraw Hill).

Geneser, F.: Histología (ed. Panamericana).

Junqueira, L.C. y Carneiro, J.: Histología básica (ed. Masson).

Krstic, R.V.: Los tejidos del hombre y de los mamíferos (ed. McGraw Hill).

Ross, M.H. y Pawlina, W: Histología. Texto y atlas color con Biología celular y molecular (ed. Panamericana).

Stevens, A. y Lowe, J.: Histología humana (ed. Elsevier).

Welsch. U.: Sobotta Welsch Histología (ed. Panamericana).

Histology of plants:

Esau, K.: Anatomía vegetal (ed. Omega)

Fahn, A.: Anatomía vegetal (ed. Pirámide)

Mauseth, J.D.: Plant Anatomy. (ed. Benjamin/Cummings)

Paniagua, R. y col.: Citología e Histología vegetal y animal (ed. McGraw Hill).

Enllaços web

http://www.hiperbotanica.net/

ATLAS

Neurohistology:

Boya, J.: Atlas de Histología y Organografía microscópica (ed. Panamericana).

Cross, P.C. y Mercer, K.L.: Cell and tissue ultrastructure. A functional perspective (ed. Freeman and Company).

Eroschenko, V.P.: Di Fiore's atlas of Histology (ed. Lea and Febiger).

Gartner, L.P. y Hiatt, J.L.: Atlas color de Histología (ed. Panamericana).

Kühnel, W.: Atlas color de Citología e Histología (ed. Panamericana).

Stanley, L.E. y Magney, J.E.: Coloratlas Histología (ed. Mosby).

Young, B. y Heath, J.W.: Histología funcional (Wheater)(ed. Churchill Livingstone).

Histology of plants:

Bowes, B.G. A colour atlas of Plant Structure, ed. Manson Pbl.

Bracegirdle, B. & Miles, P.H. Atlas de Estructura Vegetal, ed. Paraninfo.

Krommenhoek, W., Sebus, J. & van Esch, G.J. Atlas de Histología Vegetal, ed. Marbán.

Ledbetter, M.C. & Porter, K.R. Introduction to the Fine Structure of Plant Cells, ed. Springer- Verlag.

Roland, J.C. & Roland, F. Atlas de Biologie Végétale, ed. Masson.

Román, B. Tejidos vegetales, ed. Bruño.

Digital documents:

https://onlinelibrary-wiley-com.are.uab.cat/doi/book/10.1002/0471728551

https://link-springer-com.are.uab.cat/book/10.1007%2F978-3-319-41873-5

https://www-sciencedirect-com.are.uab.cat/book/9780124104242/an-atlas-of-comparative-vertebrate-histology

https://onlinelibrary-wiley-com.are.uab.cat/doi/book/10.1002/9781118924846

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Software

The software used is: "Microsoft Power Point".

Language list

Name	Group	Language	Semester	Turn
(PLAB) Practical laboratories	121	English	first semester	morning-mixed
(PLAB) Practical laboratories	122	Catalan/Spanish	first semester	morning-mixed
(PLAB) Practical laboratories	123	Catalan	first semester	morning-mixed
(PLAB) Practical laboratories	124	Catalan	first semester	morning-mixed
(SEM) Seminars	121	Catalan	first semester	morning-mixed
(SEM) Seminars	122	Catalan	first semester	morning-mixed
(TE) Theory	12	Catalan	first semester	afternoon