Teaching Guide				
Identifying Data				2022/23
Subject (*)	Biology: Basic Levels of Organisation of Life II (Tissues)		Code	610G02008
Study programme	Grao en Bioloxía			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	2nd four-month period	First	Basic training	6
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Bioloxía			
Coordinador	Castro Castro, Antonio Manuel	E-mail	antonio.castro@udc.es	
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Web				
General description	Histology, and Cytology, integrates one of the basic subjects in the Biology Grade, addressing study the complex world of the cell (Cytology) and higher levels of organization (Histology). Histology therefore aims to study the structural organization of the tissues and specific cell association, its correlation with the physiological role and histogenesis processes. In this sense, this knowledge is essential in the formation of every biologist, allowing the student understand the rest of the subjects that make up the Grade, and professional projection, especially in those professional opportunities related to health, education and research areas.			

Study programme competences / results	
Code	Study programme competences / results
A1	Recoñecer distintos niveis de organización nos sistemas vivos.
A4	Obter, manexar, conservar e observar especímenes.
A5	Analizar e caracterizar mostras de orixe humana.
A11	Identificar e analizar material de orixe biolóxica e as súas anomalías.
A29	Impartir coñecementos de Bioloxía.
A30	Manexar adecuadamente instrumentación científica.
A31	Desenvolverse con seguridade nun laboratorio.
B3	Aplicar un pensamento crítico, lóxico e creativo.
B4	Traballar de forma autónoma con iniciativa.
B5	Traballar en colaboración.
B8	Sintetizar a información.

Learning outcomes			
Learning outcomes	Study programme competences / results		
To know the basic structure of the different plant and animal tissues.	A1 A29	B3 B4 B8	
To differentiate the different types of plant and animal tissues in microscopic preparations and pictures.	A1 A5 A11 A29 A30	B3 B4	
To understand the importance of the functional interrelationship between the different tissues that make up the plant and animal organs.	A1	B3	

To know the basic structure of the different organs (plant and animals organs).	A1 A29	B3 B4 B8	
To understand and become familiar with the terminology, methodology and literature in Histology.	A4 A30 A31	B3 B4 B5 B8	

Contents	
Topic	**Sub-topic**
Lesson 1. Introduction to Histology.	Histology as subject. Concept of tissue, organ and system. Methods of study in Histology.
Lesson 2. Plant cell wall.	General characteristics. Functions. Components. Biosynthesis of cell wall components. Structure: middle lamella, primary wall and secondary wall. Origin. Plasmodesmata and pits.
Lesson 3. Internal organization of the vascular plant body.	Overview. Development of the vascular plant body. Primary growth and secondary growth. Organs and tissues of the plant body. Classification of the plant tissues. Distribution of the plant tissues.
Lesson 4. Meristems.	Concept. Characteristics and function of meristematic cells. Cell division. Classification. Primary meristems: concept, types, location and function. Secondary meristems: concept, types, location and function.
Lesson 5. Simple plant tissues.	Parenchyma. Characteristics of parenchyma cells. Origin. Distribution. Types and functions of parenchyma. Collenchyma. Characteristics of collenchyma cells. Origin. Distribution. Types and functions of collenchyma. Sclerenchyma. General characteristics. Sclereids and fibers: structure, distribution, origin, types and function.
Lesson 6. Vascular tissues I.	Xylem. General characteristics and function. Components. Conducting elements (tracheids and vessel elements): structure, origin and differentiation. Vessels: concept and types. No conducting elements: parenchyma and sclerenchyma. Classification. Primary xylem: protoxylem and metaxylem. Types. Secondary xylem: formation and organization. Growth rings. Sapwood and heartwood.
Lesson 7. Vascular tisues II.	Phloem. General characteristics and function. Components. Conducting elements (sieve cells and sieve-tube elements): structure, origin and differentiation. Albuminous cells and companion cells. No conducting elements: parenchyma and sclerenchyma. Classification. Primary phloem: protophloem and metaphloem. Secondary phloem: formation and organization. Vascular bundles.
Lesson 8. Protective tissues.	Epidermis. General characteristics. Distribution, origin and functions. Structure of ordinary epidermal cells. Cuticle: structure, composition and function. Stomata: structure, origin, distribution, function and classification. Trichomes: concept, function and classification. Periderm. Concept. Location, origin and function. Components: cork, phellogen and phelloderm. Lenticels. Secondary bark.
Lesson 9. Secretory structures in plants.	Concept. Classification. External secretory structures. Internal secretory structures.
Lesson 10. Introduction to animal histology.	Animal tissues: general characteristics, functions and classification. Fecundation and early embryogenesis. Histogenesis. Embryonic origin of the animal tissues.

Lesson 11. Epithelia I.	Concept of epithelium. Origin. Functions. Characteristics. Basal lamina. Polarity. Specialized structures in epithelial surfaces. Nutrition. Innervation. Renewal and regeneration of epithelia. General classification: criteria. Covering epithelia: classification, types and distribution.
Lesson 12. Epithelia II.	Glandular epithelium. General characteristics. Classification. Glands. Exocrine glands: structure, classification and function. Endocrine glands: concept, location, organization, cellular types and function.
Lesson 13. Connective tissue.	General characters. Origin. Functions. Classification. Connective tissue: cellular types and extracellular matrix. Types of connective tissue: mesenchymal tissue, mucous tissue, loose connective tissue, dense connective tissue, reticular tissue and elastic tissue.
Lesson 14. Adipose tissue.	General characteristics. Functions. Types. White adipose tissue: cytological characteristics, distribution, physiology and origin. Brown adipose tissue: cytological characteristics, distribution, physiology and origin.
Lesson 15. Cartilage.	General characteristics. Functions. Perichondrium. Cells. Matrix. Histogenesis and growth of the cartilage. Types of cartilage: hyaline cartilage, elastic cartilage and fibrocartilage.
Lesson 16. Bone.	General characteristics. Functions. Periosteum and endosteum. Bone cells. Bone matrix. Bone organization. Classification of bone: primary and secondary bone. Macroscopic structure: spongy bone and compact bone. Microscopic structure of the bone: lamellae and osteons. Histogenesis of bone: general considerations. Intramembranous bone formation and endochondral bone formation.
Lesson 17. Blood.	General characteristics. Functions. Constituents. Plasma. Formed elements of blood. Erythrocytes. Leukocytes: granulocytes (neutrophils, eosinophils and basophils) and agranulocytes (lymphocytes and monocytes). Platelets. Structure and function. Hemopoiesis: concept. Bone marrow and blood cells formation.
Lesson 18. Introduction to the immune system.	General characteristics. Components (types): innate immune system and adaptive immune system. Cells of the immune system. Antibodies (immunoglobulins). Complement system. Major histocompatibility complex (MHC) molecules. Humoral immunity and cell-mediated immunity.
Lesson 19. Muscle I.	General characteristics. Types and functions. Skeletal muscle. Organization. Skeletal muscle cell (fiber): structure. Myofibrils. Neuromuscular junction. Contraction.
Lesson 20. Muscle II.	Cardiac muscle and smooth muscle. Cardiac muscle: general features. Structure of the cardiac muscle cells. Intercalated disks. Regulation. Smooth muscle: general characteristics. Structure of the smooth muscle cells. Regulation. Organization. Distribution.
Lesson 21. Nervous tissue I.	General characteristics and cells of nervous tissue. Organization. Neuron: structure, function and classification. Neuroglial cells: general characteristics, types, origin and function. Central neuroglial cells: types, structure and function. Peripheral neuroglial cells: types, structure and function.
Lesson 22. Nervous tissue II.	Nerve fibers: generalities and classification. Amielinic nerve fibres. Mielinic nerve fibres: generalities. Structure and formation of myelin sheath. Peripheral nerves. Synapses: concept and classification.

Practical sessions	-Tissue preparation -Plant epidermis -Leaf structure (in dicots) -Stem structure: stems in primary and secondary growth -Root structure: primary roots in monocot and dicots -Epithelial and connective tissues (in pancreas, thyroid and trachea sections) -Bone: compact bone and endochondral bone formation -Blood -Muscle -Nervous system: neurons and neuroglia cells in vertebrate central nervous system sections

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Introductory activities		1	0	1
Guest lecture / keynote speech	A1 A29	27	70.2	97.2
Laboratory practice	A1 A4 A5 A11 A29 A30 A31 B3 B4 B5	15	19.5	34.5
Collaborative learning	A1 A29 B3 B5 B8	6	6	12
Objective test	A1 A29 B3 B5 B8	2	0	2
Mixed objective/subjective test	A1 A29 B4 B8	3	0	3
Personalized attention		0.3	0	0.3
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
Introductory activities	A first session will be programmed, in which the different sections contained in the teaching guide will be presented (learning aims, contents, planning, methodologies, assessment, sources of information...), and where the student may raise any doubt or question regarding the same. Teaching guide and a detailed schedule/timetable will be available to the students in Faculty of Science´s website.
Guest lecture / keynote speech	Throughout the semester, 27 lectures of 50 minutes about the basic contents will be taught. Professor will explain the theoretical aspects of the subject help of drawings, diagrams and computer presentations (these contents, along with links to other files and web pages, videos..., will be available to the student in the Virtual Campus platform). Professor will also resolve issues raised by the student. Explanations of the lectures will be assimilated by the student through the development of notes and subsequent study with the help of the recommended literature. Also, it is recommended that the student has previously reviewed the fundamental aspects of these lessons.
Laboratory practice	A total of 15 hours of laboratory practice will be given, and these will be mandatory (and its realization required to pass the subject). Practical sessions will consist of observing different slides and identification of tissues and organs (both plant and animal), also addressing the fundamentals of basic histological techniques and their applications. During these sessions, professor will present the objectives of the practice and will guide the student observations, making clear the doubts that arise about the identity of the observed structures.
Collaborative learning	Throughout the semester, 6 sessions (50 minutes long), will be spent working in small groups. During collaborative learning sessions, various issues related to the contents of the subject will be addressed (and discussed), and will be performed activities for which will be used specific literature (printed or through the use of electronic resources).
Objective test	Two of the collaborative learning sessions will be dedicated to make objective tests to determine the degree of assimilation of the contents. The delivered activities shall be resolved in small groups.

Mixed objective/subjective test	Student will be assessed continuously through test questions and/or short-answer questions (or relatively short-answer questions) about the contents of lectures and small group sessions (collaborative learning sessions). Two theoretical and one practical exams will be made during the semester, and a final exam for students who either have not passed these theoretical examinations and/or practical, or have not been presented to them.

Personalized attention	
Methodologies	**Description**
Mixed objective/subjective test	Students are free to discuss any concerns during the theoretical or practices sessions. Also will have the opportunity to make any questions related to the subject by attending individual tutorials reserved for it in the schedule (see schedule in https://ciencias.udc.es/en/biology-degree). In the case of students with recognition of part-time dedication and assistance exemption, they may make questions related to the subject by attending individual tutorials, email or Microsoft Teams.

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Mixed objective/subjective test	A1 A29 B4 B8	Two theoretical partial exams will be made during the semester (the first will include lessons 1-9 of the program and will represent 40%, while the second partial will include lessons 10-22 and will represent 60%), and a final exam for students who either have not passed these theoretical examinations and/or practical, or have not been presented to them. These theoretical examinations consist of multiple choice questions (multiple choice) and/or short-answer questions (or relatively short-answer questions) about the contents of lectures and small group sessions.	60
Objective test	A1 A29 B3 B5 B8	Two tests will be done: the first will include contents related to plant histology, and the second will address contents related to animal histology. These tests will consist of a combination of different types of questions: multiple-choice questions, short answer, essay type questions, identification schemes/images, complete and/or association.	10
Guest lecture / keynote speech	A1 A29	Attendance and active participation at theoretical (lectures and small groups) and practical classes is necessary for assessment.	5
Laboratory practice	A1 A4 A5 A11 A29 A30 A31 B3 B4 B5	Students will make a practical examination which will represent 25% of the final grade. The practical examination shall consist of the identification, interpretation and analize of images of histological sections and/or slides, both plant and animal. It may also include questions relating to the fundamentals and applications of basic histological techniques.	25
Collaborative learning	A1 A29 B3 B5 B8	Attendance and active participation at theoretical (lectures and small groups) and practical classes is necessary for assessment.	0

Assessment comments

General considerations:
Students will have two official opportunities to pass
the subject. Likewise, there will be 2 partial theoretical exams and a
practical exam during the semester.

As already mentioned, the practices are compulsory and
their completion is necessary to pass the subject.

The grade of Not Presented will be applied in the
event that the student does not appear for the corresponding tests in the
official evaluation opportunities.
Aspects and evaluation criteria:

1. Full-time students

In the opportunity of the end of the semester (first
opportunity), the different sections collected in the evaluation system will be
taken into account for the computation of the global qualification, each of
these must be passed to proceed to the calculation of the final qualification.
As already indicated, there will be two theoretical partial exams (and one
practical) during the semester (the first of the theoretical partial exams will
represent 40%, while the second one will represent 60%), as well as a final
exam for students who either have not passed these exams, or have not taken
them, representing 60% of the final grade. The practical exam will account for
25% of the final grade. The realization of the objective tests during the
sessions in small group will suppose 10% of the final qualification, while the
attendance and active participation in the theoretical classes (lectures and
sessions in small group) and practices will suppose 5% of the final
qualification. On the second opportunity, the theoretical (all parts) and/or practical parts may be recovered, assuming 75% and 25% of the final grade, respectively.

2. Students with recognition of part-time dedication
and academic waiver of attendance exemption

Both in the first opportunity and in the second
opportunity, the qualification obtained in the theoretical exam and the one
corresponding to the practical part will be taken into account for the
computation of the overall qualification (see format of both above),
representing 75% and 25% of the final grade, respectively.

Note:

In order for the qualifications in the different
activities subject to evaluation to be taken into account, it is necessary to

pass (reach 50% of the qualification) each of the sections/tests that make up the evaluation system. If this score is not achieved in any of them and even if the average of the different sections/tests is equal to or greater than 5, the subject will appear as a failure and the grade will be 4.9. The fraudulent performance of the tests or evaluation activities will entail the application of current regulations in this regard.

Sources of information	
Basic	- Evert, RF (2008). Esau Anatomía vegetal. Meristemas, células y tejidos de las plantas: su estructura, función y desarrollo. Ed. Omega. 3ª Edición - Alonso Peña, JR (2011). Manual de Histología Vegetal. Mundi-Prensa - Brüel, A, Christensen, EI, Tranum-Jensen, J, Qvortrup, K y Geneser, F (2015). Geneser. Histología. Ed. Médica Panamericana. 4ª Edición - Pawlina, W (2020). Ross. Histología. Texto y atlas. Correlación con Biología Molecular y Celular. Ed. Wolters Kluwer, 8ª Edición - Welsch, U (2014). Sobotta. Histología. Con la colaboración de Thomas Deller. Ed. Médica Panamericana. 3ª Edición

Complementary	Histoloxía vexetal: libros complementarios-Álvarez Nogal, R 2008, Prácticas de citología-histología de plantas y animales, Universidad de León-Secretariado de Publicaciones, León. -Bowes, BG & Mauseth, JD 2008, Plant structure. A colour guide, 2ª edición, Ed. Manson Publishing, Londres. -Bracegirdle, B & Miles, PH 1975, Atlas de estructura vegetal, Ed. Paraninfo, Madrid. -Cortés, F 1990, Cuadernos de Histología Vegetal, Marban, Barcelona. -Crang, R, Lyons-Sobaski, S & Wise, R 2018, Plant Anatomy. A concept-based approach to the structure of seed plants, Springer Nature Switzerland AG, Cham.-Esau, K 1985, Anatomía Vegetal, Omega, Barcelona. -Evert, RF 2006, Esau´s plant anatomy, Wiley-Interscience, Hoboken. -Fahn, A 1985, Anatomía Vegetal, Pirámide, Madrid. -Fahn, A 1990, Plant Anatomy, Pergamon Press, Oxford. -Gómez Segade, P 2012, Atlas de histología vegetal, Ed. Lulu, Madrid. -Krommenhoek, W, Sebus, J & van Esch, GJ 1986, Atlas de Histología Vegetal, Ed. Marban, Madrid. -Paniagua, R, Nistal, M, Sesma, P, Álvarez-Uría, M, Fraile, B, Anadón, R & Sáez FJ 2007, Citología e Histología Vegetal y Animal, 4ª edición, McGraw-Hill Interamericana, Madrid. -Raven, PH, Evert, RF & Eichhorn, SE 1991, Biología de las plantas, Ed. Reverté, Barcelona. -Santamarina Siurana, MP 2009, Atlas de anatomía vegetal, Universidad Politécnica de Valencia, Valencia. -Stevenson, FF & Mertens, TR 1990, Anatomía Vegetal, Limusa, México.Histoloxía animal: libros complementarios -Bergman, RA, Afifi, AK & Heidger, PM 1997, Histología, McGraw-Hill Interamericana, México. -Berman, I 2003, Color atlas of basic histology, 3ª Edición, Lange Medical Books/McGraw-Hill, Nueva York. -Bloom, W & Fawcett, DW 1995, Tratado de Histología, Interamericana, Nueva York. -Boya Vegue, J 2011, Atlas de histología y organografía microscópica, 3ª edición, Editorial Médica Panamericana, Madrid. -Cónsole, G & Vidal, M 2017, Atlas de histología. Clasificación, correlación clínica, autoevaluación, Ediciones Journal, Buenos Aires. -Contamina Gonzalvo, P, Parra, P & García Rojo, M 2011, Prácticas de histología: primer curso, Prensas Universitarias, Zaragoza. -Cui, D, Naftel, JP, Lynch, JC & Yang, G 2011, Histología con correlaciones funcionales y clínicas, Wolters Kluwer Lippincott Williams & Wilkins, Filadelfia. -Eynard, AR, Valentich, MA & Rovasio, RA 2008, Histología y embriología del ser humano: bases celulares y moleculares, 4ª edición, Médica Panamericana, Buenos Aires. -Fawcett, D & Jensh, RP 1999, Compendio de Histología, McGraw-Hill Interamericana, Madrid. -Fortoul, T 2013, Histología y biología celular, 2ª edición, McGraw Hill, México D.F. -Gartner, LP & Hiatt, JL 2008, Texto atlas de Histología, 3ª edición, McGraw-Hill Interamericana, México. -Gartner, LP & Hiatt, JL 2011. Atlas en color de histología, 5ª edición, Panamericana, Madrid. -Gartner, LP & Hiatt, JL 2011, Histología básica, Elsevier, DL, Barcelona. -Geneser, F 1985, Atlas color de Histología, Panamericana, Madrid. -Junqueira, LC & Carneiro, J 2015, Histología Básica. Texto y atlas, 12ª edición, Editorial Médica Panamericana, Madrid. -Kerr, JB 2010, Functional histology, 2nd edition, Mosby, Sydney. -Kierszenbaum, AL & Tres, LL 2012, Histología y Biología Celular. Introducción a la Anatomía Patológica, 3ª edición, Elsevier, Barcelona. -Kühnel, W 2005, Atlas color de citología e histología, 11ª edición, Editorial Médica Panamericana, Madrid. -Lee, LMJ 2014, Lippincott's pocket histology, Wolters Kluwer. 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Fundamentos de biología celular y del desarrollo humano, Panamericana, Madrid. -Ross, MH, Pawlina, W & Barnash, TA 2012, Atlas de histología descriptiva, Panamericana, Buenos Aires. -Ruiz, MS, Rodicio, C & Corujo, A 1985, Cuaderno de prácticas de citología e histología vegetal y animal, Universidad de Santiago de Compostela, Santiago de Compostela. -Sepúlveda Saavedra, J & Medina Hernández, RM 2011, Histología. Biología celular y tisular. Instructivo de laboratorio, 5ª edición, McGraw-Hill Interamericana, México. -Singh, I 2011, Textbook of human histology: with colour atlas and practical guide, 6th edition, Jaypee Brothers Medical Publishers, New Delhi. -Sontakke, Y 2020, Textbook of human histology: with color atlas, 3D illustrations and flowcharts, CBS Publishers & Distributors, New Delhi.-Villaro

Gumpert, AC 2021, Histología para estudiantes, Editorial Medica Panamericana, Madrid.-Wheater, PR 1987, Histología funcional. Texto y atlas en color, 2ª Edición, Ed. JIMS, Barcelona. -Young, B & Heath, JW 2000, Wheater´s Histología funcional texto y atlas en color, 4ª edición, Elsevier, Madrid. RECURSOS WEBXerais: https://books.google.es/ https://pubmed.ncbi.nlm.nih.gov/https://www.europeana.eu/eshttps://archive.org/Libros electrónicos
udc:https://www.udc.es/gl/biblioteca/recursos_informacion/libros_electronicos/index.htmlHistoloxía/Organografía vexetal: http://www2.estrellamountain.edu/faculty/farabee/BIOBK/BioBookPLANTANAT.html http://www.biologia.edu.ar/botanica/index.html http://www.sbs.utexas.edu/mauseth/weblab/ http://mmegias.webs.uvigo.es/inicio.html http://www.ujaen.es/investiga/atlas/ Histoloxía/Organografía animal:http://www.meddean.luc.edu/lumen/MedEd/Histo/frames/histo_frames.html http://www1.udel.edu/biology/Wags/histopage/histopage.htmhttp://www.e-histologia.unileon.es/1inicio/home/Indexhistol800x600.html#Principio http://www.ujaen.es/investiga/atlas/ http://mmegias.webs.uvigo.es/inicio.html http://www.facmed.unam.mx/deptos/biocetis/atlas2013A/tomo1.htmlhttps://campus.usal.es/~histologia/histologia.htm

Recommendations
Subjects that it is recommended to have taken before
Biology: Basic Levels of Organisation of Life I (Cells)/610G02007
Subjects that are recommended to be taken simultaneously
Biochemistry I/610G02011
Subjects that continue the syllabus
Microscopic Organography/610G02009 Developmental Biology/610G02010
Other comments
It is strongly recommended to read or work on the subject of lectures and small group sessions and take notes. Students to find a particular difficulty in following classes or in addressing the issues that make up the program (both theoretical and practical) can go to individualized tutoring (see schedule in https://ciencias.udc.es/en/biology-degree).