



Teaching Guide				
Identifying Data				2016/17
Subject (*)	Histoloxía	Code	610G02008	
Study programme	Grao en Bioloxía			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	2nd four-month period	First	FB	6
Language	Spanish			
Teaching method	Face-to-face			
Prerequisites				
Department	Bioloxía Celular e Molecular			
Coordinador	Castro Castro, Antonio Manuel	E-mail	antonio.castro@udc.es	
Lecturers	Castro Castro, Antonio Manuel Díaz Prado, María Luz Lamas Criado, Iban	E-mail	antonio.castro@udc.es luz.diaz@udc.es iban.lamas@udc.es	
Web	https://campusvirtual.udc.es/moodle/			
General description	Histology, and Cytology, integrates one of the basic training materials on 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, his knowledge and mastery is essential in the formation of every biologist, being Histology of basic discipline for students to understand and properly encaren the rest of the materials that make up the Grado, and professional projection, especially those professional opportunities related 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 espécimes.
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	B3
		A29	B4
			B8
To differentiate the different types of plant and animal tissues in microscopic preparations and pictures.		A1	B3
		A5	B4
		A11	
		A29	
		A30	



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. Growth of the cell wall. 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 tissues 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. Secretion in plants. 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.	Concept. 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. Histogenesis of bone: general considerations. Intramembranous bone formation and endochondral bone formation. Bone remodeling.
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. 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 and origin. 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. Cardionector system. Regulation. Smooth muscle: general characteristics. Structure of the smooth muscle cells. Contraction of smooth muscle. 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 and nervous impulse. Nerve fibers: generalities and classification. Amielinic nerve fibres. Mielinic nerve fibres: generalities. Structure of myelin sheath. Peripheral nerves. Generation and transmission of the nervous impulse. Synapses: Concept and classification. Electrical synapses. Chemical synapses: structure, function and types. Neurotransmitters.



Practical sessions	<ul style="list-style-type: none"> -Tissue preparation -Leaf structure -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 -Striated and smooth muscle tissues -Nervous system: neurons and neuroglia cells in vertebrate central nervous system sections
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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	25	67.5	92.5
Laboratory practice	A1 A4 A5 A11 A29 A30 A31 B3 B4 B5	15	24	39
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		0.5	0	0.5

(*)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 to the presentation of the course where the various sections contained in the teaching guide will be presented will be devoted (learning aims, contents, methodologies, assessment, sources of information...), and where the student may raise any doubt or question regarding the same. Also a printed version of this teaching guide and a detailed schedule of the activities will be delivered. This documentation, along with a full version of the teaching guide, will be available to the student in the Moodle platform.
Guest lecture / keynote speech	Throughout the semester, 25 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 Moodle 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. 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 (approximately 10 students). 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 testing, 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 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 exceeded these theoretical examinations and/or practical, or have not been presented to them.
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Personalized attention

Methodologies	Description
Mixed objective/subjective test	<p>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 http://ciencias.udc.es/grao-en-biologia).</p> <p>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 or by email.</p>

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 exceeded 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 on the contents of lectures and small group sessions.	65
Objective test	A1 A29 B3 B5 B8	Two (written) tests will be done: the first will include content 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, 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 evaluation.	5
Laboratory practice	A1 A4 A5 A11 A29 A30 A31 B3 B4 B5	Students will undertake a practical examination which will represent 20% of the final grade. The practical examination shall consist of the identification and interpretation of images of histological sections and / or slides, both plant and animal.	20
Collaborative learning	A1 A29 B3 B5 B8	Attendance and active participation at theoretical (lectures and small groups) and practical classes is necessary for evaluation.	0

Assessment comments



Consideracións xerais:

O alumno disporá de dúas oportunidades

oficiais para superar a materia (final de cuadrimestre e xullo). Así mesmo, realizaranse 2 exames parciais teóricos e un exame práctico liberatorios ao longo do cuadrimestre.

A cualificación de Non

Presentado aplicarase no caso de que o estudante non se presentase ás probas correspondentes nas oportunidades oficiais de avaliación.

Aspectos e criterios de avaliación:

1. Alumnado con dedicación completa

Na

oportunidade de final de cuadrimestre teranse en conta, para o cómputo da cualificación global, os distintos apartados recollidos no sistema de avaliación, debéndose superar cada un destes para proceder ao cálculo da cualificación final (global). Como xa se indicou, realizaranse dous exames parciais teóricos escritos (e un práctico) durante o período lectivo da materia (o primeiro dos parciais representará un 40%, mentres que o segundo suporá o 60%), así como un exame final para os alumnos que ou ben non superasen devanditos exames teóricos e/ou práctico, ou ben non se presentaran aos mesmos, representando o 65% da cualificación final. O exame práctico suporá o 20% da cualificación final. A realización das actividades expostas (proba obxectiva) durante as sesións en grupo reducido suporá o 10% da cualificación final, mentres que a asistencia e participación activa nas clases teóricas (maxistras e sesións en grupo reducido) e prácticas suporá o 5% da cualificación final.

Como xa se indicou as prácticas son obrigatorias, e necesaria a súa realización para superar a materia.

Na

oportunidade final de xullo poderase/n recuperar a/s parte/s non superada/s, teórica (no seu conxunto) e/ou práctica, representando éstas o 80% e o 20% da cualificación final, respectivamente.

2. Alumnado con recoñecemento de dedicación a

tempo parcial e dispensa académica de exención de asistencia

Tanto

na oportunidade de final de cuadrimestre como na oportunidade final de xullo teranse en conta, para o cómputo da cualificación global, a calificación obtida no exame teórico e a correspondente á parte práctica (ver máis arriba formato de amolos dous exames), representando éstas o 80% e o 20% da cualificación final, respectivamente.

Nota:

Para que se teñan en conta as cualificacións nas distintas actividades suxeitas a avaliación é preciso superar (alcanzar o 50% da cualificación) cada un dos apartados que integran o devandito sistema de avaliación. De non alcanzarse dita puntuación nalgunha delas e aínda que a media dos distintos apartados sexa igual ou superior a 5 (sobre 10) a materia figurará como suspensa e a cualificación de 4,9.



Basic	<ul style="list-style-type: none">- Evert, RF (2008). Esau Anatomía vegetal. Meristemas, células y tejidos de las plantas: su estructura, función y desarrollo. Ed. Omega. 3ª Edición- Paniagua, R, Nistal, M, Sesma, P, Álvarez-Uría, M, Fraile, B, Anadón, R y Sáez, FJ (2007). Citología e Histología Vegetal y Animal. Ed. McGraw Hill Interamericana. 4ª Edición- Brüel, A, Christensen, EI, Trantum-Jensen, J, Qvortrup, K y Geneser, F (2015). Geneser. Histología. Ed. Médica Panamericana. 4ª Edición- Ross, MH y Pawlina, W (2016). Ross. Histología. Texto y atlas. Correlación con Biología Molecular y Celular. Ed. Wolters Kluwer, 7ª Edición- Welsch, U (2014). Sobotta. Histología. Con la colaboración de Thomas Deller. Ed. Médica Panamericana. 3ª Edición
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<p>Complementary</p>	<p>Histoloxía Vexetal Alonso Peña, JR 2011, Manual de Histología Vegetal, Mundi-Prensa, Madrid. 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. 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, Lulu, Madrid. Krommenhoek, W, Sebus, J & van Esch, GJ 1986, Atlas de Histología Vegetal, Ed. Marban, 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 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. 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 & Jensch, RP 1999, Compendio de Histología, McGraw-Hill Interamericana, Madrid. 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, Barcelona. Junqueira, LC & Carneiro, J 2005, Histología Básica. Texto y atlas, 6ª edición, Masson, Barcelona. 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. Leeson, CR, Leeson, TS & Paparo, AA 1990, Texto Atlas de Histología, Interamericana-McGraw-Hill, México. Montuenga, L, Esteban, FJ & Calvo, A 2009, Técnicas en histología y biología celular, Elsevier-Masson, Barcelona. Olmos, G, Miralles, A 2003, Prácticas de citología e histología, Universitat de les Illes Balears, Palma (Islas Baleares). 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. 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. Stevens, A & Lowe, J 2007, Histología humana, 3ª edición, Elsevier, Madrid. Wheeler, PR, 1987, Histología funcional. Texto y atlas en color, 2ª Edición, Ed. JIMS, Barcelona. Young, B & Heath, JW 2000, Wheeler's Histología funcional texto y atlas en color, 4ª edición, Elsevier, Madrid. Recursos web: Xerais http://books.google.es/http://www.ncbi.nlm.nih.gov/pubmed Histoloxía/Organografía Vexetal http://www.biologia.edu.ar/botanica/index.html http://atlasveg.ib.usp.br/English/focara.html http://images.botany.org/http://www.sbs.utexas.edu/mauseth/web/lab/http://www.dipbot.unict.it/tavole_es/indice.html http://www.ujaen.es/invstiga/atlas/http://mmegias.webs.uvigo.es/inicio.html http://www2.estrellamountain.edu/faculty/farabee/BIOBK/BioBook PLANTANAT.html Histoloxía/Organografía Animal http://www.kumc.edu/instruction/medicine/anatomy/histoweb/http://www.meddean.luc.edu/lumen/MedEd/Histo/frames/histo_frames.html http://www.udel.edu/Biology/Wags/histopage/histopage.htm http://escuela.med.puc.cl/publ/Histologia/Indice.html http://www.e-histologia.unileon.es/1inicio/home/Indexhisto1800x600.html#Principio http://www.ujaen.es/investiga/atlas/http://mmegias.webs.uvigo.es/inicio.html</p>
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Recommendations

Subjects that it is recommended to have taken before

Citología/610G02007



Subjects that are recommended to be taken simultaneously

Bioquímica: Bioquímica I/610G02011

Subjects that continue the syllabus

Organografía microscópica/610G02009

Biología do desenvolvemento/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 at <http://ciencias.udc.es/grao-en-biologia>).

(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.