Teaching Guide				
Identifying Data				2022/23
Subject (*)	Animal Physiology I		Code	610G02035
Study programme	Grao en Bioloxía			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	1st four-month period	Third	Obligatory	6
Language	Galician			
Teaching method	Face-to-face			
Prerequisites				
Department	Bioloxía			
Coordinador	Couceiro López, Lucía	E-mail	lucia.couceiro@udc.es	
Lecturers	Álvarez Bermúdez, María	E-mail	maria.alvarez.bermudez@udc.es	
	Couceiro López, Lucía		lucia.couceiro@udc.es	
Web				
General description	The animal as an open system and an integrated whole. Exchange of matter and energy with the environment. Study of the different animal functions and their regulation. A comparative perspective.			

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.
A10	Avaliar actividades metabólicas.
A17	Realizar bioensaios e diagnósticos biolóxicos.
A18	Levar a cabo estudos de produción e mellora animal e vexetal.
A19	Analizar e interpretar o comportamento dous seres vivos.
A21	Deseñar modelos de procesos biolóxicos.
A26	Deseñar experimentos, obter información e interpretar os resultados.
A28	Desenvolver e implantar sistemas de xestión relacionados coa Bioloxía.
A29	Impartir coñecementos de Bioloxía.
A30	Manexar adecuadamente instrumentación científica.
A31	Desenvolverse con seguridade nun laboratorio.
B1	Aprender a aprender.
B2	Resolver problemas de forma efectiva.
B3	Aplicar un pensamento crítico, lóxico e creativo.
B4	Traballar de forma autónoma con iniciativa.
B5	Traballar en colaboración.
B6	Organizar e planificar o traballo.
B7	Comunicarse de maneira efectiva nunha contorna de traballo.
B8	Sintetizar a información.
B9	Formarse unha opinión propia.
B11	Debater en público.

Learning outcomes	
Learning outcomes	Study programme competences / results

To show basic knowledge about the functioning of animals as an integrated whole, which can be applied in the management of organisms in experimental conditions, cultivation, production, etc., as well as to evaluate the incidence of possible environmental changes.	A1 A10 A19 A21 A26 A28 A29 A30 A31	B1 B3 B8 B9	
To show skills of potential application in the laboratory clinic in intensive and extensive culture.	A4 A10 A17 A18 A26 A28 A30 A31	B2 B3 B4 B6	
To define concepts, to abstract and to manage information from different sources (bibliographic, experimental, virtual management, etc.).	A26 A29	B5 B6 B8 B11	
To work in groups as well as to design, to elaborate and to present works	A29	B5 B6 B7 B8 B11	

Contents	
Topic	**Sub-topic**
Introduction: Units 1 and 2.	Unit 1. Animal Physiology as a Science: concept and historical perspective. Functional features of animals. The animal and its environment: the external environment and determinants of physiological processes. Concept of internal environment and its constancy. Concept of homeostasis and the homeostatic mechanism. Unit 2. Substance transfer through biological membranes. Origin of the transmembrane potential. Membrane potentials: resting potential and action potential. Ionic basis of the action potential. Action potential propagation: diffusion of excitation / impulse transmission.

Nutrition and digestive function. Bioenergetics: Units 3 to 7.	Unit 3. Nutrition: nutritional requirements. Capturing and swallowing food mechanisms. Regulation of food intake. Overview of the digestive systems: types of digestion, digestive systems and stages of digestion. Unit 4. Functional regions of the digestive tract (I). Reception: chewing and salivation. Swallowing, transmission and storage. Esophageal peristalsis. Control of gastric motility and gastric emptying. Structure and innervation of the gastrointestinal muscle. Intestinal motility and reflexes. Unit 5. Functional regions of the digestive tract (II). Secretions: salivary, gastric, pancreatic, biliary and small intestine and regulation. Digestive enzymes of invertebrates. Structure of the absorption mucous membrane. Digestion of food and gastrointestinal absorption: physical and chemical processes involved. Absorption of carbohydrates, proteins and fats. Absorption of water, electrolytes and vitamins. Digestion and absorption in ruminants. Posterior tract fermenters. Intestine: motility and secretions. Formation of feces and defecation. Unit 6. Bioenergetics. Energetics in organisms and heat production. Metabolic rate: definition and meaning. Factors affecting metabolic rate: activity, size and body surface, hormonal balance, etc. Metabolism measuring methods. Unit 7. Body temperature. Ectotherm and endotherm animals. Production mechanisms and heat transfer. Adaptations to cold and heat in ectotherms and endotherms. Regulatory mechanisms of body temperature. Biological rhythms and lethargy: sleep, torpor, hibernation and estivation.
Respiratory Systems: Units 8 to 11.	Unit 8. Respiratory systems. Oxygen availability: gases in air and in water. Gas exchange in aquatic environments. Fish as a model of aquatic respiration: breathing through gills. Role of skin in breathing. Unit 9. Gas exchange in the air environment. Tracheal and pulmonary respiration. Pulmonary respiration: functional structure and respiratory mechanics. The avian lung: a unidirectional mechanism. Unit 10. Regulation of respiration. Nervous regulation. Chemoreceptors and baroreceptors in the regulation of breathing. Regulation and exercise. Unit 11. Exchange-transfer of gas and gas transport. Respiratory pigments. Function of hemoglobin and myoglobin in oxygen transport and dissociation curves or O2 equilibrium curves. Factors which influence the affinity of hemoglobin for oxygen. Bohr Effect. CO2 transport and equilibrium curves, and input from the tissues and unloading. Haldane effect.
Circulatory Systems: Units 12 to 15.	Unit 12. Circulation: general considerations and types of cardiovascular systems. Propulsion Systems: Types of heart. Evolution of the vertebrates heart. Unit 13. The myogenic heart: physiology of the heart muscle. Cardiac excitation: cardiac automaticity and rhythmicity (sinoatrial node function as pacemakers). Intracardiac conduction. The neurogenic heart. The heart pump. The cardiac cycle: correlation of electrical and mechanical events, and the heart. Cardiac output. Regulation of heart activity: intrinsic, nervous, and hormonal regulation. Unit 14. Hydrostatic and hydrodynamic principles applied to hemodynamics. The arterial system. Determinants of blood pressure. Venous circulation. Venous pressure. Regulation of blood circulation (self, nervous and hormonal regulation). Baroreceptors and chemoreceptors. Capillary circulation: exchange between the capillaries and the intercellular spaces. Pulmonary circulation. Coronary circulation. Cerebral circulation. The lymphatic system, structure and function of the tissue drainage mechanism. Unit 15. Body fluids. Circulating fluids: types and composition. Cellular elements. Immunity. Hemostasis and blood coagulation. Hemostatic systems in different animals.

Ionic-osmotic balance and excretion: Units 16 to 19.	Unit 16. Osmoregulation and environment. Environmental parameters of the aquatic and terrestrial environments. Osmoregulation in aquatic animals: strategies for water-salt regulation in the iso-osmotic, hyperosmotic and hyposmotic media. Water and electrolyte problems of terrestrial life. Unit 17. Excretory function and excretory products: cleansing of body fluids and maintaining their volumes. The excretion of nitrogenous products. The excretory organs of invertebrates: nephridium modalities and Malpighian tubule system. The kidney of vertebrates: the Loop of Henle and the ability to form hyperosmotic urine. Functional anatomy. Unit 18. The kidney of mammals (I). Basic mechanisms of urine formation: glomerular filtration, tubular secretion and reabsorption. Diversity of the tubular segments and their function. Glomerular filtration rate, renal clearance and maximum transport. Unit 19. The kidney of mammals (II). Regulation by the kidney of the Na+, K+ and Cl- ions. Other ions. Regulation of renal function and urine concentration: countercurrent multiplier system. Role of mineralocorticoids. Regulation of body volume: antidiuretic hormone. Renal function and blood pressure: the renin-angiotensin system. The acid-base balance and the need for its maintenance. Regulation.

Planning				
Methodologies / tests	Competencies / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Introductory activities	B6 B8 B9	1	0.5	1.5
Guest lecture / keynote speech	A1 A19 A29 B1 B3 B6 B8 B9	27	54	81
Seminar	A18 A19 A21 A28 A29 B1 B2 B3 B5 B7 B8 B9 B11	8	10	18
Laboratory practice	A4 A10 A17 A26 A28 A29 A30 A31 B1 B2 B3 B4 B5 B6 B7 B8 B9 B11	15	7.5	22.5
Supervised projects	B1 B3 B4 B5 B6 B7 B8 B9	0	20	20
Objective test	A1 A18 A29 B1 B3 B4 B8 B9	3	0	3
Personalized attention		4	0	4
(*)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	The first hour of the course will be dedicated to the presentation of the subject. The theoretical program will be briefly presented and the different activities will be explained, as well as the evaluation system. Although attendance is not compulsory, it is highly RECOMMENDED.
Guest lecture / keynote speech	Guest lectures (27 sessions with a duration of 50 minutes each) will be conducted through oral sessions with the support of audiovisual media. In them, 19 units with the main contents of the subject will be presented. The material used in these sessions will be available to students through the Moodle platform. Although attendance is not compulsory, it is highly RECOMMENDED.

Seminar	Seminars will be conducted during theory hours in interactive groups. They will focus on some of the most relevant topics previously dealt with in the guest lectures, for which activities of different nature will be carried out: watching videos, elaboration of materials, presentation of papers, etc. The activities and/or associated short tests, carried out in the context of these seminars, will be considered as part of the individual evaluation of the student. Although participation in them is not compulsory, it is highly RECOMMENDED.
Laboratory practice	The laboratory practices are COMPULSORY. In them, different organisms will be handled (sometimes using a virtual environment) in order to study the different functions addressed in the theoretical program.
Supervised projects	Students can carry out, in small groups and OPTATIVELY, a work that will allow them to deepen in the physiology of a particular group/species. Its elaboration will be periodically supervised by the teachers, in person or using telematic means (e-mail, Moodle or Microsoft Teams).
Objective test	Test that combines different types of questions on the main aspects/contents of the theoretical program. Alternatively, students will have the possibility of taking 3 partial objective tests throughout the course that will allow them to pass the course through continuous evaluation.

Personalized attention	
Methodologies	**Description**
Laboratory practice Supervised projects	Personalized attention will be given to the students during the laboratory practices. Throughout these practices, students will be able to make questions and address specific issues related to the theoretical program of the subject and the practices themselves. Students will also be able to receive personalized attention by attending to the professors' office during tutoring hours or by telematic means (e-mail, Moodle or Microsoft Teams). In addition, the teachers will monitor the work developed by the students (supervised project) so that the final product reaches an acceptable quality; such monitoring may be carried out in person or through telematic means (email, Moodle or Microsoft Teams). It should be noted that, in the event that there may be students enrolled assimilated as "Students with recognition of part-time dedication and academic dispensation of exemption from attendance", they will have the traditional tutorials and, in particular, those focused on complementing their possible non-participation in the seminar activities that would take place throughout the academic year. Likewise, and with regard to the practical activities that may not have been developed by these students -in case of having the appropriate dispensation-, tutorials aimed at providing information about them will also be contemplated, thus facilitating the evaluation of this fraction of students.

Assessment			
Methodologies	**Competencies / Results**	**Description**	**Qualification**
Laboratory practice	A4 A10 A17 A26 A28 A29 A30 A31 B1 B2 B3 B4 B5 B6 B7 B8 B9 B11	The laboratory practices are mandatory; at their end, there will be a test on the Moodle platform on the content addressed. The grade obtained in this test will represent 14% of the final grade. In addition, as in the case of the seminars, the grade obtained in this test will remain unchanged for the computation of the final grade in the case of the students who have to attend the second opportunity (July).	14
Seminar	A18 A19 A21 A28 A29 B1 B2 B3 B5 B7 B8 B9 B11	The tasks performed during the seminars and/or the associated short tests will be evaluated. The grade obtained will represent 16% of the final grade. Students who do not attend the seminars and, therefore, do not perform the associated tasks/short tests, will obtain a grade of 0 points in the activity scheduled that day. The grade obtained in the seminars will remain unchanged for the computation of the final grade in the case of the students who have to attend the second opportunity (July).	16

Objective test	A1 A18 A29 B1 B3 B4 B8 B9	This is a test with different types of questions on the main aspects/contents of the theoretical program taught in the guest lectures. The grade obtained will represent 55% of the final grade (maximum 5.5 points out of 10; however, it is necessary to obtain a minimum of 4 points out of 10 in this test to pass the subject). Alternatively, students will have the option of taking 3 partial objective tests throughout the course (as in the case of evaluation by means of a single test, students must obtain a minimum of 4 points out of 10 in each of the partial tests in order to pass the course).	55
Supervised projects	B1 B3 B4 B5 B6 B7 B8 B9	This work, of optional character, will be evaluated according to the depth of the content, the presentation and clarity of the organization, the use of a language proper of the disciplinary context and the quality of the bibliographic sources used. The grade obtained will represent 15% of the final grade. The grade obtained in the supervised project will remain unchanged for the computation of the final grade in the case of the students who have to attend the second opportunity (July).	15

Assessment comments
For the evaluation of the subject, the knowledge of the theoretical program and the laboratory practices will be taken into account, as well as the supervised project and the associated activities and/or short tests carried out in the context of the seminars. The knowledge acquired, the comprehension and synthesis capacity, the expository clarity and the acquired skills will be evaluated. In order to pass the subject, the stipulated evaluation criteria must be met and a minimum score of 5.0 points must be obtained. For the final grades of both opportunities, students who do not attend the objective tests on the official dates will be considered NOT PRESENT. Students who attend the objective tests but do not reach the overall score of 5.0 points or have a grade in the objective test lower than 4.0 points out of 10 (regardless of the grade for seminars, laboratory practicals and supervised project) will be considered SUSPENDED. In the case that the total sum of the grades is equal or higher than 5.0 points but the partial of theoretical contents (objective test) does not exceed the minimum grade required, the final numerical grade will be the one achieved in the aforementioned test of theoretical contents. Those students who opt for continuous evaluation will need to achieve a minimum of 4.0 points in each and every one of the partial tests. Students who do not achieve this score in any of the tests will be automatically excluded from this evaluation system and must do the final objective test of the whole subject. Repeating students who have passed the laboratory practices in the three immediately previous years may keep the grade of these or, if they wish, improve it. Students with recognition of part-time dedication and academic dispensation of exemption from attendance may request the necessary calendar changes to ensure the possibility of attending any of the evaluable activities scheduled in the subject. In the case of fraudulent performance of tests or evaluation activities, once verified, the UDC regulations in force in this regard will be applied. Students who request to take the advanced call in December will be governed by what is indicated in the teaching guide of the previous academic year.

Sources of information	
Basic	- Silverthorn, D.U. (2014). Fisiología Humana. Un enfoque integrado (6ª ed.). Ed. Cambridge University Press - Stanfield, C.L. (2011). Principios de Fisiología Humana (4ª ed.). Ed. Pearson Educación - Guyton, A.C. & J.E. Hall (2011). Tratado de Fisiología Médica (12ª ed.). Ed. Interamericana McGraw-Hill - Hill, R.W.; G.A. Wyse & M. Anderson (2006). Fisiología Animal. Ed. Panamericana - Moyes, C.H. & P.M. Schulte (2007). Principios de Fisiología Animal. Ed. Pearson Educación - Randall, D.; W. Burggren & K. French (2002). Ecker Animal Physiology. Mechanisms and Adaptations (5ª ed.). W.H. Freeman and Company - Schmidt-Nielsen K. (1997). Animal physiology. Adaptation and environment (5ª ed.). Ed. Cambidge University Press

Complementary	- Berta, A.; J.L. Sumich & K.M. Kovacs (2006). Marine Mammals: Evolutionary Biology (2nd ed.). Academic Press - Chown, S.L. & S.W. Nicolson (2004). Insect Physiological Ecology. Oxford University Press - Eddy, F.B. & R.D. Handy (2012). Ecological and Environmental Physiology of Fishes. Oxford University Press - Evans, D.E. & J.B. Claiborne (2006). The Physiology of fishes. CRC Press - Harrison, J.F.; H.A. Woods & S.P. Roberts (2012). Ecological and Environmental Physiology of Insects. Oxford University Press - Mittai, A.K.; F.B. Eddy & J.S. Dattamunshi (1999). Water/air transition in Biology. Science Publishers Inc. - Nation, J.L. (2008). Insect Physiology and Biochemistry (2nd ed.). CRC Press - Willmer, P.; Stone, G. & Johnston, I. (2000). Environmental Physiology of Animals. Blackwell Science Ltd.

Recommendations
Subjects that it is recommended to have taken before
Microscopic Organography/610G02009 Biochemistry I/610G02011 Biochemistry II/610G02012 Zoology I/610G02031 Zoology II/610G02032
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Animal Physiology II/610G02036
Other comments
Guest lectures are recommended in order to follow the theoretical program of the subject. It is also essential that students make use of the virtual platform of the UDC (Moodle) for the development of the subject. It is required to know how to write, synthesize and present a work in an orderly manner, on theoretical and/or practical contents. It is recommended to have user level knowledge of basic computer tools (navigation, word processing, preparation of presentations, etc.). Knowledge of English with an average reading comprehension level is recommended.Green Campus Science Faculty ProgramIn order to help achieve an immediate sustainable environment and comply with point 6 of the "Declaración Ambiental da Facultade de Ciencias (2020)", the documentary works to be carried out in this subject:a. Will be requested mostly in virtual format and computer support.b. For those to be done on paper:- Plastics will not be used.- Double-sided printing shall be used.- Recycled paper shall be used.- Drafts shall be avoided.

(*)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.