Teaching Guide				
Identifying Data				2023/24
Subject (*)	Developmental Biology		Code	610G02010
Study programme	Grao en Bioloxía			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	2nd four-month period	Fourth	Optional	6
Language	SpanishGalician			
Teaching method	Face-to-face			
Prerequisites				
Department	Bioloxía			
Coordinador	Yañez Sanchez, Julian	E-mail	julian.yanez@udc.es	
Lecturers	Folgueira Otero, Mónica Yañez Sanchez, Julian	E-mail	m.folgueira@udc.es julian.yanez@udc.es	
Web	https://campusvirtual.udc.gal			
General description	Development is an outstanding process of selfconstruction (and also renovation) of all multicellular organisms from the unicellular condition. This course is an optional subject in the second semester of 4th year (8th semester) in which it integrates information and biological knowledge taken in previous years. This course cover the study of the cellular basis and molecular mechanisms involved in the process of ontogenetic development of multicellular organisms, especially in the processes of differentiation and morphogenesis, emphasizing primarily in the development of metazoans.			

Study programme competences	
Code	Study programme competences
A1	Recoñecer distintos niveis de organización nos sistemas vivos.
A4	Obter, manexar, conservar e observar especímenes.
A26	Deseñar experimentos, obter información e interpretar os resultados.
A29	Impartir coñecementos de Bioloxía.
A30	Manexar adecuadamente instrumentación científica.
A31	Desenvolverse con seguridade nun laboratorio.
B1	Aprender a aprender.
B4	Traballar de forma autónoma con iniciativa.
B6	Organizar e planificar o traballo.
B8	Sintetizar a información.
B10	Exercer a crítica científica.
B11	Debater en público.
B13	Comportarse con ética e responsabilidade social como cidadán e como profesional.

Learning outcomes			
Learning outcomes	Study programme competences		
Understand the fundamentals, processes and trends of developmental of muticellular organisms.	A1 A4 A29	B1 B4 B8 B11	
To study the cellular and molecular mechanisms underlying developmental processes, particularly those involved in the differentiation and morphogenesis	A1 A4 A29	B4 B8 B11	
To know and be familiar with the methodologies, experimental processes, instrumentation and technical terms, based on the scientific method to the study of Developmental Biology	A26 A30 A31	B6 B10 B13	

Contents	
Topic	**Sub-topic**
I. Concepts and Processes of Development from a historical perspective	Multicellularity, Morphogenesis and differentiation. Epigenesis vs. Preformation. Mosaic and regulative development . Induction. Ontogeny and Phylogeny.
II. Gametogenesis and the beginning of Development	Spermatogenesis. Oogenesis. Fertilization. Parthenogenesis.
III. Early Development	Segmentation Gastrulation Organization of body patterns Neurulation and neural crest Somitogenesis Extraembryonic membranes Gestation and Placentation
IV. Differentiation mechanisms and Organogenesis	Development of the nervous system and sense organs Development of muscle and the tetrapode limbs Development of the vertebrate circulatory system Development of the vertebrate urogenital system
V. Furhter topics of Development	Overview of plant development. Metamorphosis and regeneration Enviromental interactions with animal development Developmental mechanisms in the evolutionary change
Practical lessons	Comparative study of spermatogenesis and oogenesis Studies on Planarian regeneration Observation and study of invertebrate fertilization Observation of fish and amphibian early development Observation of chick early development and organogenesis

Planning				
Methodologies / tests	**Competencies**	**Ordinary class hours**	**Student?s personal work hours**	**Total hours**
Introductory activities	A1	1	0	1
Directed discussion	A26 A1 B1 B10 B11	20	52	72
Seminar	A29 B1 B4 B6 B8 B10 B11 B13	7	24.5	31.5
Laboratory practice	A4 A26 A30 A31 B13	14	14	28
Workbook	A4 A26 A30 B4	0	3	3
Mixed objective/subjective test	A1	2.5	8	10.5
Personalized attention		1	0	1
(*)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	This session consists of a presentation of the subject, which sets out and explains the purpose and objectives of the subject, its structure, activities, evaluation criteria, etc ... (all contained in summary in the teaching guide) and where student can solve any queries related to them.

Directed discussion	Sessions (flipped classrooms) will be 50 minutes long covering the topics of the program, on which the student must have previously worked from the recommended texts and the edited document of the topic provided by the lecturer. In the session, the most important and complex concepts will be analyzed and, doubts arised from personal work or from those activities carried out in the session (study cases, design and interpretation of experiments, gamified activities...) will be solved.
Seminar	Each seminar session will be presented and discussed among participants about a scheduled topic. Students should prepare their own theme or part of the intended subject assigned. The teacher will assist any questions that may arise along the preparation.
Laboratory practice	The practices are an essential complement to the theoretical lessons which addresses some of the processes of animal development and elaborates on some of them.
Workbook	This section includes specifically selected audiovisual media (videos from the JoVe or YouTube platforms) about methodological, experimental or illustrative aspects of the embryogenesis of some animal species.
Mixed objective/subjective test	The examination shall be written and consist of short answer questions of the contents treated in lectures, seminars and practical lessons.

Personalized attention	
Methodologies	**Description**
Directed discussion Seminar	the lecturer will assign a particular topic each student within the general theme for each seminar discussion. Moreover, the student is free to discuss any concerns during the keynote sessions and practices, and also have the opportunity to resolve any questions about these subject or activities in personal tutorials

Assessment			
Methodologies	**Competencies**	**Description**	**Qualification**
Directed discussion	A26 A1 B1 B10 B11	In the modality of continuous evaluation, the activities carried out throughout the course in these sessions may be taken into account and valued, representing 70% of the final grade, and may be replaced by the mixed test. The student who does not complete a minimum of 80% of these activities will not be able to opt for this evaluation modality and must take the mixed test.	0
Mixed objective/subjective test	A1	the examination will be written and consist of short answer questions, doing schemas, definitions ...	70
Seminar	A29 B1 B4 B6 B8 B10 B11 B13	For each seminar session the student must give a talk on a topic previously assigned and give the teacher a brief one-page summary including the main ideas of the subject worked. In the seminar session, the ideas in common will be discussed among participants. Both the presentation and the discussion will be valued. The 8 seminars represent the 30 percent of the final grade (each seminar is worth 0,375 points over 10). Abstracts not presented and defended in the seminar session will not be assessed.	30
Others			

Assessment comments

It is not necessary to achieve a minimum score on the topics of the seminars and the directed discussion activities/ mixed test for the calculation of the final grade. Students who followed the continuous assessment modality can choose to increase their grade by taking the mixed test. In the second call only the score of the written exam in which knowledge derived from theoretical, practical sessions and seminars will be assessed, will be considered.
The fraudulent performance of the tests or activities, once verified, will directly imply a failure grade "0" in the contents of the corresponding opportunity.
Exceptionally, in case the student under justified reasons (students with part-time dedication and academic exemption or specific circumstances of learning and support for diversity) or supervening circumstances, cannot take all the continuous assessment tests, appropriate alternative measures or activities there will be adopted that do not affect the student rating.
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The student who does not carry out the activities of the continuous evaluation modality and/or the final mixed test will be considered not presented.
General criteria of UDC will be applied in the commitment to respect enviromental values and gender perspective
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Sources of information	
Basic	- Gilbert, S.F. (2004, 2014). Biología del Desarrollo/ Developmental Biology. Panamericana/SINAUER - Wolpert, L. (2010/ 2011). Principios del desarrollo/ Principles of Development. Panamericana/ Oxford University Press ENLACES DE INTERÉS: Developmental Biology (8th Edition)The virtual embryoZygoteAmphibian embryology tutorial with QuickTime movies. Anatomy of the 24, 48, 72 and 120 hours Zebrafish (Danio rerio) Embryo. Developmental Biology ON LINE!. Fly Morph-o-genesis Medakafish developmental stage map. Stages of Zebrafish Development The Interactive Fly The Multi-Dimensional Human Embryo. I Embryo ImagesThe Visible Embryo Morphing EmbryosThe Xenopus Molecular Marker ResourceSociety of developmental biology
Complementary	- Browder L.W., Erikson C.A., and Jeffrey W.R. (1991). Developmental Biology. Saunders - Kalthoff, K. (1996). Analysis of Biological Development. Mc Graw-Hill - Müller A.W. (1997). Developmental Biology. Springer-Verlag - Carlson, B.M (2000). Embriología Humana y Biología del Desarrollo.. Harcourt - Gilbert S.F., Epel D (2009). Ecological Developmental biology. Sinauer

Recommendations
Subjects that it is recommended to have taken before
Biology: Basic Levels of Organisation of Life I (Cells)/610G02007 Biology: Basic Levels of Organisation of Life II (Tissues)/610G02008 Biochemistry I/610G02011 Biochemistry II/610G02012 Genetics/610G02019 Animal Physiology I/610G02035 Animal Physiology II/610G02036
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Other comments
Assistance and active participation to all activities is highly recommended. It is also encouraged previous consulting and personal working on the programmed issues before discussion in the flipped classroom sessions. Continued study throughout the course is also recommended to strengthen knowledge and for better understanding the new content being treated.